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Mariners Weather Log

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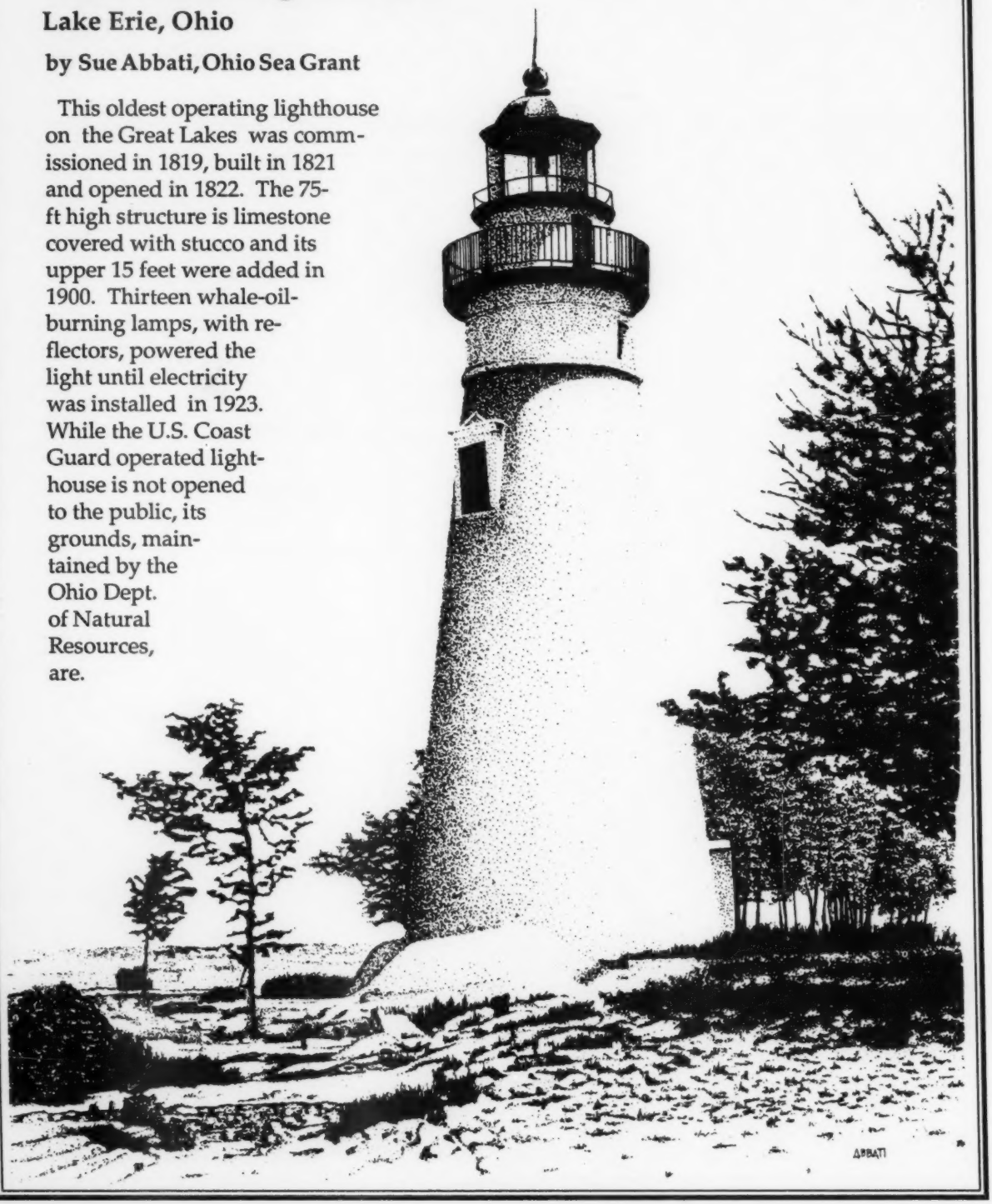
Marblehead Lighthouse

Lake Erie, Ohio

by Sue Abbati, Ohio Sea Grant

This oldest operating lighthouse on the Great Lakes was commissioned in 1819, built in 1821 and opened in 1822. The 75-ft high structure is limestone covered with stucco and its upper 15 feet were added in 1900. Thirteen whale-oil-burning lamps, with reflectors, powered the light until electricity was installed in 1923. While the U.S. Coast Guard operated lighthouse is not opened to the public, its grounds, maintained by the Ohio Dept. of Natural Resources, are.



Mariners Weather Log

October– November– December, 1987, Vol. 31, No. 4
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The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 1, 1988.

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Cover and back: Bob Collins, PMO Chicago, caught this spectacular roll cloud at the finish of the Mackinaw Race on July 19th. See page 22 for details.

U. S. DEPARTMENT OF COMMERCE
C. William Verity, Secretary
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NATIONAL ENVIRONMENTAL SATELLITE, DATA AND INFORMATION SERVICE
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FOG SONGS

— by Elinor DeWire

"FOG. The very mention of it conjures images of a vague and treacherous course. Light as a bride's veil or opaque as 'pea soup', it has bewildered even the keenest navigators since time immemorial. Yet this cloak of saturated uncertainty — a commingling of miniscule water droplets that may number 25,000 to the square inch — has not failed to inspire humankind"

Whenever fog shrouds the seaway, a symphony unfolds. Lilting chimes, monotone clanks and bongs, shrieking sirens, mournful horns warn an unsure mariner when lights fail to penetrate the murk. The musicians in this briny orchestra have often been ridiculed for their harsh and repetitious tones, but they perform a critical service to mariners, guiding their course by the characteristic and number of sounds produced.

They are the humble, unapplauded fog signals— nostalgic troubadours of the sea whose songs have echoed through the centuries.

Early seafarers employed crude noisemakers to steer in fog. Fishermen's wives banged pans or whistled through the thick air when it was time for their husbands to return home. Warships listened for the sound of a gun in foggy weather. A pounding drum led the Vikings to safety, and an imperial gong aided ancient China's eggboats caught in the freak mists of rivers.

An old trick in fog that is still used by Maine lobstermen is to listen for echoes from nearby headlands and cliffs. A toot of the horn or a hearty shout will bounce back to the sender. Some skippers believe a barking dog aboard ship gives the best echo. It might also set shore dogs barking in response, in which case the seaman knows the ship is too close to land.

Other seasoned old-timers claim to be able to identify a fog-obscured coast by its smell and go about with their nostrils dilated in expectation of a familiar scent.

Echoes and salty aromas aside, the best guidepost in fog, other than today's high-technology radio and satellite communications, is the dependable and noisy fog signal. Even the captain of a huge oil tanker, with every state-of-the-art navigational gadget at his fingertips, will tell you a groaning foghorn imparts a sense of security unequaled by modern bleeps and pings. But sound signals do have drawbacks.

Fog, particularly thick fog, plays tricks with sound. It may refract sound waves, causing them to travel unexpected paths that lead the listener to mistake their point of origin. Fog may also reflect sound waves away entirely, in which case the listener is unable to hear them. Since the density of fog can vary greatly, it is not impossible for the mariner to pick up a sound signal miles away, lose it upon drawing nearer, and then suddenly be overwhelmed by its loud return only a short distance from its point of origin.

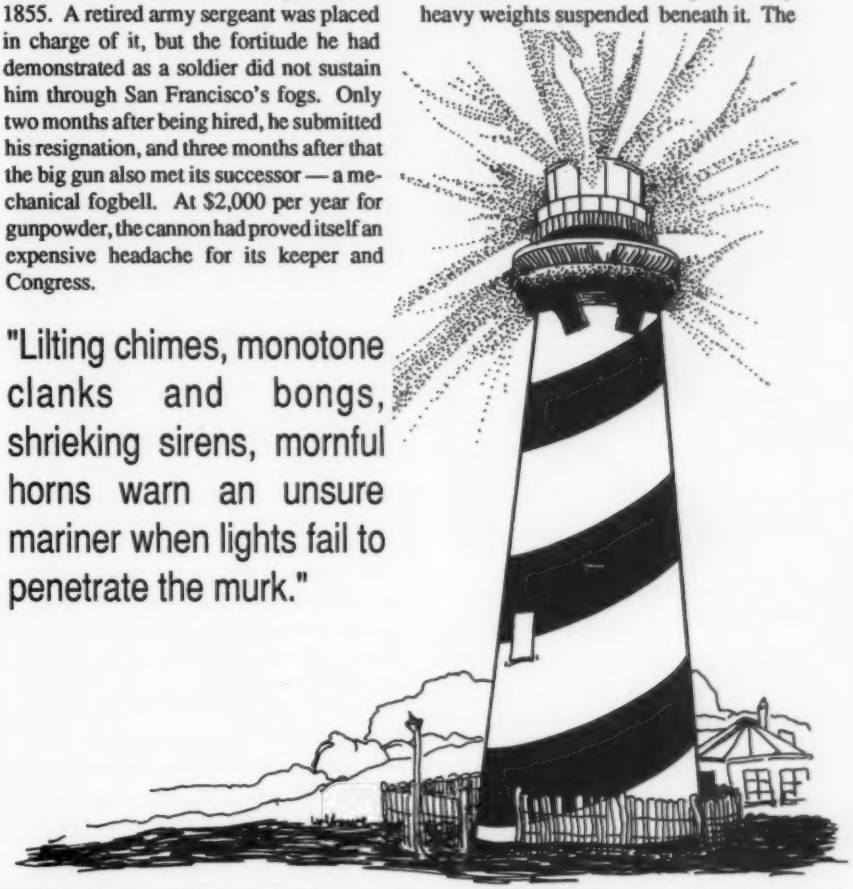
In 1719, the third keeper of Boston Lighthouse petitioned the town for "a great Gun to answer Ships in Fogg." His suggestion was approved, and a cannon was positioned near the lighthouse and was fired every half hour in periods of low visibility. At the behest of this former sea captain, who was undoubtedly familiar with the tricks of fog, America had its first, official fog signal.

West Quoddy Head, Maine and Point Bonita, California were among the other coasts in the nation to employ fog cannons. Point Bonita's rumbling gun came from Benicia Arsenal and went into operation in 1855. A retired army sergeant was placed in charge of it, but the fortitude he had demonstrated as a soldier did not sustain him through San Francisco's fogs. Only two months after being hired, he submitted his resignation, and three months after that the big gun also met its successor — a mechanical fogbell. At $2,000 per year for gunpowder, the cannon had proved itself an expensive headache for its keeper and Congress.

"Lilting chimes, monotone clanks and bongs, shrieking sirens, mornful horns warn an unsure mariner when lights fail to penetrate the murk."

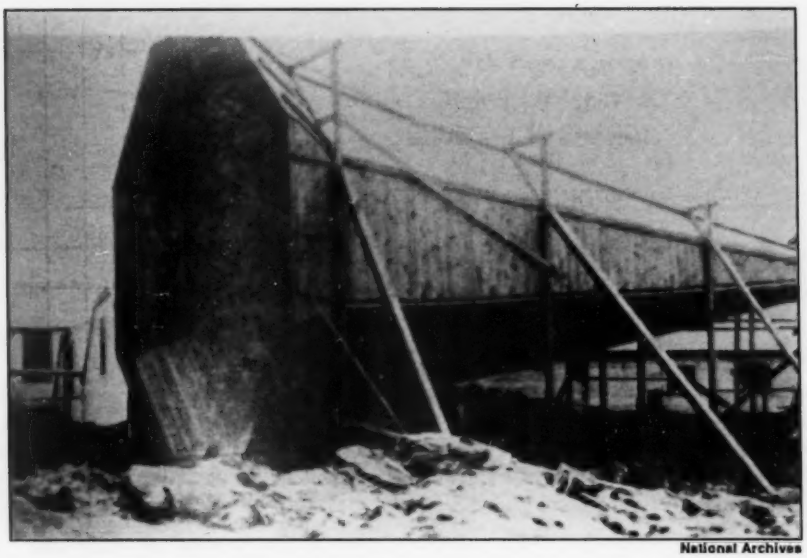
Fogbells came into use in the United States about 1820 and remained popular for many years. America's first one replaced the cannon at West Quoddy Head, Maine. The bell weighed 500 pounds and was manually struck by the lighthouse keeper, who received an extra $60 a year for his labors. If conditions permitted, the bell's warning was heard up to 5 miles, but sea air often played ominous games with it, speeding up or slowing down its doleful sound or obliterating it.

By 1860 fogbells of titanic size were being cast, and mechanical strikers were developed for them. The huge bell at Ediz Hook, Washington weighed 3,150 pounds and caused the metal parts of the entire station to hum each time it struck. The 4,000-pound bell at Trinidad Head, California was anchored into a cliff 126 feet above the sea with its striker powered by heavy weights suspended beneath it. The



keeper wound up the weights every few hours but, during a persistent fog in 1900, the cable holding them snapped, and they plunged into the sea never to be retrieved.

About 1850, a Canadian music teacher named Robert Foulis came up with world's first steam powered fog signal. Coming home one night, Foulis heard his daughter playing the piano and was amazed to discover one particular low note stood out above the others. Foulis identified the note and reproduced it using a steam whistle mounted on a steam boiler. The Canadian government allowed him to install the steam signal at the harbor of Saint John, New Brunswick. When the first heavy fog rolled in, the deep voice of Foulis' extraordinary apparatus droned well beyond the harbor, ushering in a new era in fog warning.



National Archives

A giant Daboll fog trumpet at Boston Lighthouse, circa 1890.

Elinor DeWire

A fog bell sits outside the U.S. Coast Guard Academy Library.

Celadon Daboll of New London, Connecticut took up where Foulis left off with experiments involving compressed air signals. Daboll constructed trumpets of varying sizes to amplify the sound created by compressed air vibrating a reed. His largest experimental trumpet was installed at Boston Lighthouse in the 1890's.

Daboll was also innovative in the power sources he created for his noisy signals. In 1852, the strangest of his inventions went into service at Rhode Island's Beavertail Lighthouse. Its power source was a concoction of hay, grain, and water, for that is what kept its steadfast, old draft horse plodding slowly around the windlass hour after hour. Though the system appears to have worked well, the horse lost his job to a steam whistle with a cantankerous boiler that had to be fired up whenever fog crept in.

A clever fog signal powered by the rise and fall of the tide was installed at Maine's Whitehead Lighthouse in the 1830's, but a more glamorous sea-powered signal went into service at California's Farallon Islands in 1859. The source of energy for this sea-actuated apparatus was a big blowhole over which engineers built a brick chimney with a locomotive whistle in its top. A writer with Harper's Magazine in 1874 romantically described it as a "huge trumpet, blown by the rush of air through a cave or passage connecting with the ocean," but the signal was not problem-free.

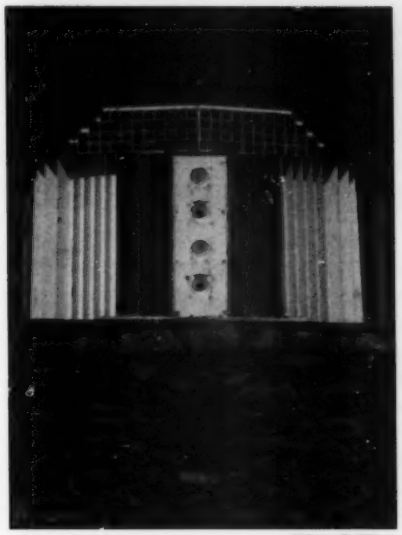
"Until the conversion to electricity in the 1920's, compressed air signals were powered by fuel-hungry engines."

The sea is normally calm in periods of fog, and wave motion within the cave was not sufficient to force air through the whistle. On the other hand, when days dawned clear and windy, and the sea roared through the cave, the whistle screamed continuously as if it were a train gone berserk. During one storm, water forced through the blowhole exploded into the chimney with such power that it blew the structure completely off its foundation. Convinced the idea was worthwhile, engineers rebuilt the signal, and it remained in operation until 1871 when a second severe storm destroyed it.

A siren fog signal was developed in the United States in 1868 using compressed air forced through a disk. The Canadian Lighthouse Service introduced a two-tone diaphone horn a few years later by forcing compressed air through a slotted, reciprocating piston. Along with the diaphragm horn, developed in the 1880's and able to produce sounds of varying pitch by means of a vibrating disk diaphragm, these three types of signals became the mainstay of twentieth century fog warning.

Until the conversion to electricity in the 1920's, compressed air signals were powered by huge, fuel-hungry engines. The diaphone horn at lofty Point Reyes, California consumed 140 pounds of coal an

hour and required a long serpentine chute to bring down the fuel on a cable car. With Point Reyes logging over 2,500 hours a year, the signal needed to preform flawlessly, but it did not.



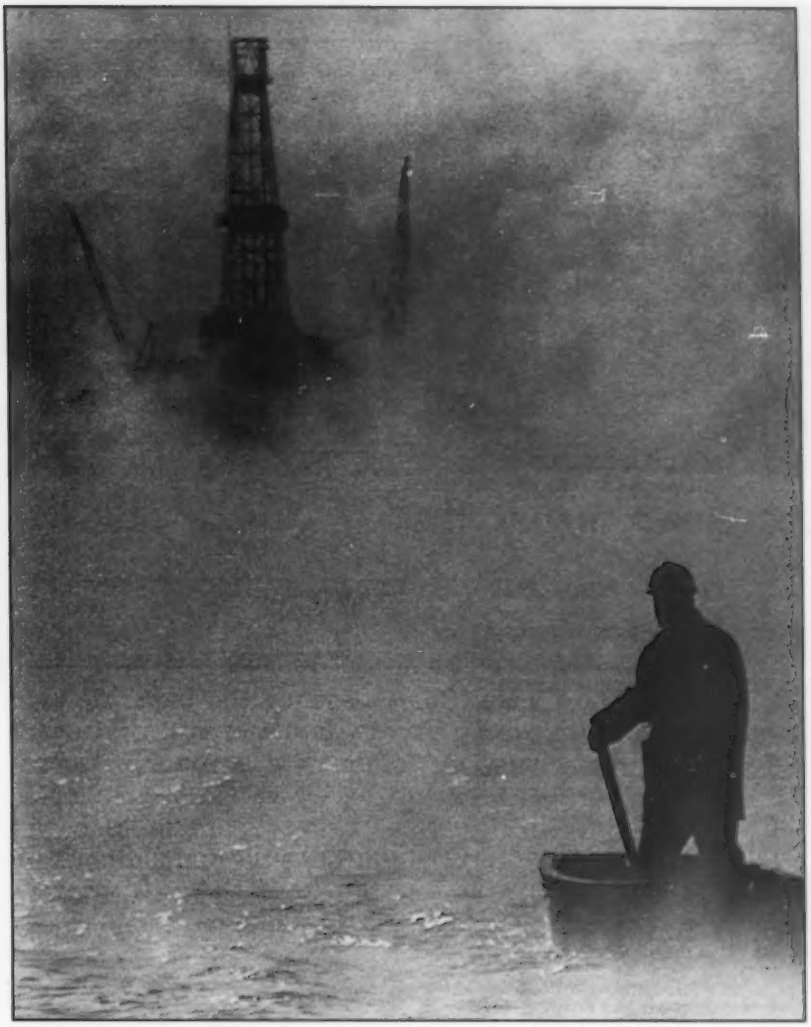
Elinor DeWire

This fog signal is supported by an old lighthouse foundation at Beavertail, R.I.

"The keepers prize bull alone amid a harem of cows, mistook the bellowing horn for a rival male and set out to establish his supremacy."

In 1875, the coal cable snapped, sending its little car careening down the chute and into the lighthouse. Additionally, vibrations from the station's blasting horn were causing rockslides and undermining the cleft on which the lighthouse was perched. As if these mishaps were not enough, the son of one Point Reyes lightkeeper was seriously injured while using the coal chute for a sliding board.

The groaning horn at Destruction Island, Washington performed satisfactorily, but caused raucous behavior on the part of one of the island's residents. The keeper's prize bull, alone amid a harem of cows, mistook the bellowing horn for a rival male and set out to establish his supremacy. Several weeks and a number of fences later, the beleaguered beast mellowed a bit, but he was always alert for any intrusion upon his domain when the horn roared into action.



Fog of the "pea soup" variety.

Despite the blare of foghorns and the screech of sirens, bells had not disappeared from service. The government was continually improving bells and their striking mechanisms. By the 1920's, bells were electrically operated, and a device had been developed to automatically actuate their strikers. The hygroscope contained a moisture-sensitive cell that triggered the electrical power to the bell striker when humidity approached 100 percent.

At Baltimore Lighthouse Depot in 1921, an unusual hygroscope composed of human hair was tested. Experiments had shown hair responds to dryness by stretching and to dampness by contracting. A long, Chinese pigtail was attached to the electrical switch of the striker on a 2,000-pound fog bell, and its designers anxiously awaited a foggy day. Their invention came to life unexpectedly a few days later during the dedication ceremony for the Francis Scott Key Memorial. The day was sunny

Elinor DeWire

The bell and clapper show the wear of time on this bell buoy.

and clear, but fireboats were rocketing water over the harbor in celebration. Moisture drifted across the harbor to the fog bell, and the Chinese pigtail began to contract. In the middle of a moving speech by President Warren Harding, the insubordinate bell suddenly came alive, sending its urgent clangs over a fogless bay.

Bells also proved ideal as warning on buoys. Bell buoys have been in use since 1885 and depend upon the motion of the sea to actuate their clappers, or sound by means of a timed hammer powered by batteries or compressed gas.

Gong buoys produce a distinctive, resonant sound and are easily differentiated from bell buoys. Their melodious tune, usually four-toned, is produced by separate clappers mechanically struck, or haphazardly gonged as the buoy rocks on the waves.

Whistle buoys were developed in 1876 for use in open areas where the sea's motion is sufficient to produce compressed air and force it through a whistle head. By 1930, a trumpet mechanism powered by electric batteries induced their shrill warnings. Today, combination buoys employ several methods to issue warnings, but most still rely on the archaic but dependable bell as a backup system when ultramodern technology fails.

The music of foggy bays and harbors has not always been appreciated, particularly in large cities where the noise extends over a populous area. When New York City's Great Captain Island received a sparkling, new fog siren in 1905, nearby residents protested. A local newspaper reporter used such comparisons as "an army of panthers ... roar of a thousand bulls ...wail of a lost soul...moan of a bottomless pit... and groan of a disabled elevator" to describe the unpopular siren.

"The grateful mariner aside, there are few individuals who feel a genuine affection for the lowly fog signal."

The government did what it could to mollify annoyed neighbors of fog signals by installing deflector panels and extolling the virtues of sound signals in aiding those at the mercy of the sea. But even the keepers of the signals sometimes objected to their endless din.

It was the crusty, old bulimic fog signal at remote Point Reyes — ravenously con- that drove one keeper mad and, in the words of a San Francisco reporter, made "its jaded attendants look as if they had been on a protracted spree."

The grateful mariner aside, there are few individuals who feel a genuine affection for the lowly fog signal. Both Rudyard Kipling and Robert Southey extolled the perilous watch in their writings, and a composer from California once wrote a symphony based on the sounds coming from San Francisco Bay during fog. School children in Canada still sing "The Foghorn Song," an energetic rendition of the sounds a music teacher heard in Vancouver Harbor.

One individual, however, was unable to fathom the purpose of a fog signal or the need for it. He was an Indian and a descendant of the Continent's earliest seamen. After watching a foghorn being installed on the West Coast in the 1800's, the sage old man observed both the sea and the blaring signal for many days. He then concluded that the horn was useless, for despite its terrifying noise and hideous appearance, it failed to frighten away the fog, which came in with the same regularity it had for untold millenniums.

Elinor DeWire

The test site for numerous fog warning devices — Beavertail Lighthouse, R.I.

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NOMAD Buoy

Discus Buoy

Buoy Records

Set in 1985 Hurricanes

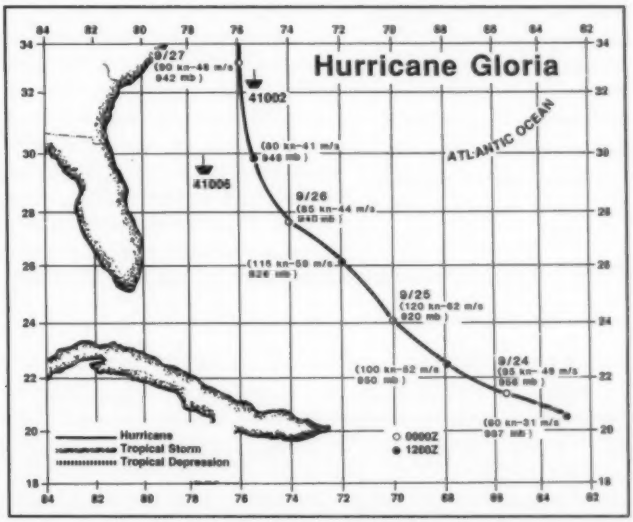
— by Glenn D. Hamilton
National Data Buoy Center
NSTL, MS

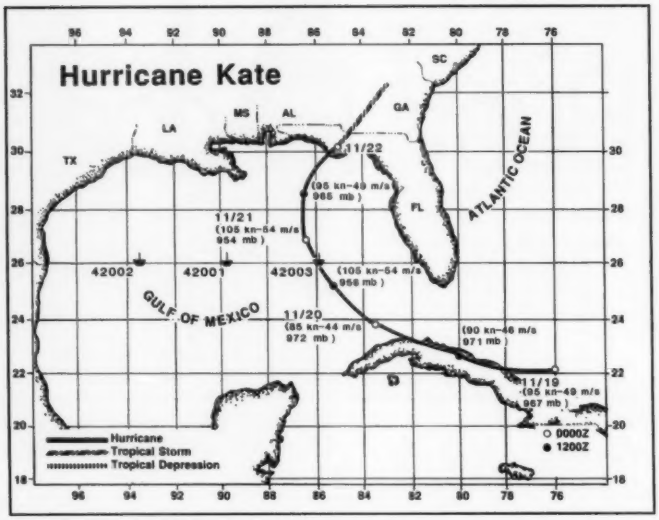
Two interesting events occurred during the 1985 hurricane season. In September, a North Atlantic buoy reported the highest significant wave height ever recorded by the National Data Buoy Center (NDBC) in a hurricane (Gloria)— 46.9 feet. The following month in the eastern Gulf of Mexico an NDBC buoy registered a record 92-knot wind with a 114-knot peak in Kate. The apparent dichotomy is that at the time the records were set, winds were less than would be expected at the North Atlantic buoy and waves were less than anticipated at the eastern Gulf of Mexico station.

Hurricane Gloria had its start near the Cape Verde Islands on September 16. Even though it was somewhat late in the season for Cape Verde storms, the system managed to maintain its westward track across the tropical Atlantic. However, prior to reaching the Leeward Islands, Gloria turned toward the northwest. On the 23d and 24th, as Gloria pursued a track parallel to and just east of the Bahamas, the central pressure within the hurricane fell at a rate of 2 millibars per hour to a minimal pressure of 919 millibars. On the 26th Gloria passed within 55 miles of buoy station 41002, off the South Carolina coast. The buoy reported a maximum significant wave height of 46.9 feet with a wind speed of 49 knots at 2000Zon the 26th. This is the highest wave height ever recorded by an NDBC buoy in a hurricane and compares with the record of 48.5 feet in the northeast Pacific (Hamilton 1982).

Development of Kate began just northeast of the Virgin Islands on November 13th. The system was a tropical storm by the 15th. Moving westerly it strengthened to hurricane force by 1800Z on the 16th. Kate had a central pressure of 967 millibars by the time it moved onto the northern Cuban coast on the 19th. Tracking inland along the northern coast, Kate produced minimal hurricane winds. After Kate emerged over the waters of the southeast Gulf of Mexico, it strengthened at a rate of nearly 1 millibar per hour, reaching minimal pressure of 953 millibars by 2000Z on the 20th.

Kate's center passed very close to NDBC's buoy station 42003 in the eastern Gulf about the same time Air Force reconnaissance was in the hurricane. Pressure measurements from the dropsonde and the data buoy were in close agreement. Aircraft measured the central pressure of Kate at 956 millibars while the data buoy had a reading of 957 millibars. During this period the aircraft was measuring peak winds





of 100 to 109 knots while the data buoy reported an 8.5-minute averaged wind of 92 knots with a peak wind of 114 knots.

The buoy at station 41002 was a NOMAD (Navy Oceanographic and Meteorological Automatic Device which is a 20-foot long, boat-shaped, aluminum hull with the anemometers at the 15-foot level above the water. Station 42003 was occupied by a 33-foot discus buoy that had anemometers at the 33-foot level. An evaluation of NDBC moored buoy winds has been made by Gilhousen (1987). NDBC hull types have been calibrated with Waverider buoys to estimate the hull transfer coefficients needed for wave measurements.

Using a numerical wave prediction scheme we can compare the expected wind and wave values. A method by Ross is summarized in two curves in Long (1979). Applying the required values of wind speeds from the times of the most extreme wind/wave conditions at the two buoys, the significant wave height ($H_{1/3}$) and peak period (T_m) are estimated (computed) as follows:

Station (hurricane)	$H_{1/3}$ Computed	$H_{1/3}$ (Measured)	T_m Computed	T_m (Measured)
41002 (Gloria)	27.6 feet	(46.9 feet)	16.0 seconds	(16.7 seconds)
42003 (Kate)	30.1 feet	(35.1 feet)	11.2 seconds	(12.5 seconds)

The estimates during Kate are reasonably close as is the peak period for Gloria. However, there is a large discrepancy in the significant wave height predicted for Gloria. There appear to be several characteristics of the storms that may explain the difference.

"The highest sea state in a hurricane occurs in the right front quadrant of the storm."

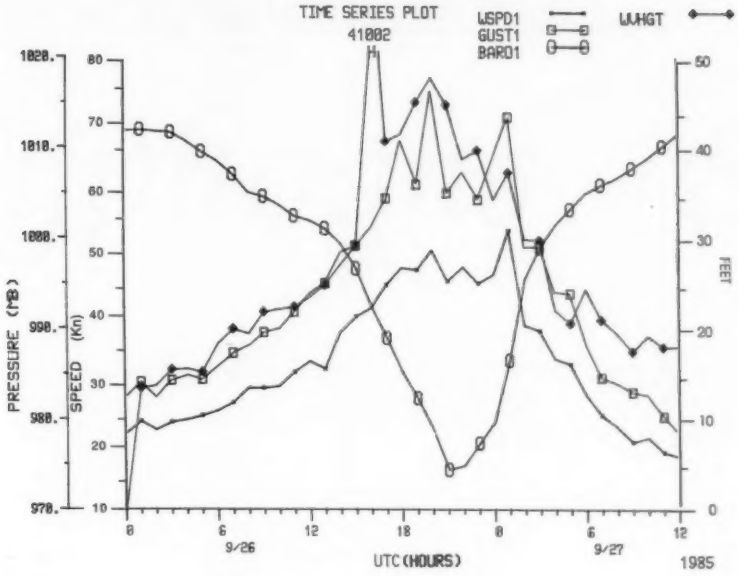
The following interpretation of the discrepancy between wind speeds and wave heights in the two storms was suggested by Dr. Robert B. Long of the Atlantic Oceanographic and Meteorological Laboratory of NOAA.

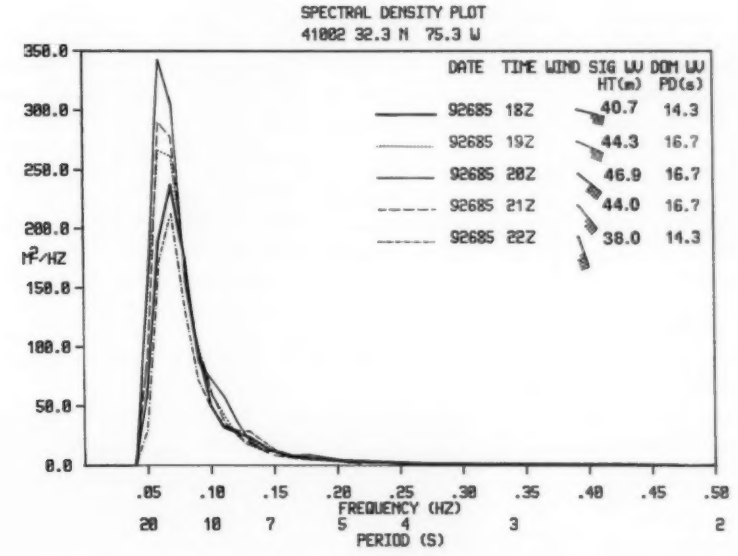
Suppose one considers the sea state at the buoy to be made up of a superpositon of wave packets having characteristic frequencies, group velocities and energy content. The energy content of any given packet will depend on the history of winds experienced by that packet. The most energetic packets will be those whose group speed nearly match the storm's forward speed and pass to the right of the eye, outside the radius of maximum winds. These waves remain the longest in the region where winds are high and directions are favorable for wave growth. The highest sea state in a hurricane occurs in the right front quadrant of the storm. Here the sea is dominated by wave packets, each propagating along its own ray path at speeds greater than the storm's forward speed. In the absence of a sheltering coastline, these packets have been born at the rear of the storm, and have subsequently grown under the influence of the hurricane winds until arriving at the site of the sea state maximum at observation time. However, if the storm were partly over land at some time in its recent past, a packet present at the specified time in the area of sea state maximum may have been initiated at the sheltering shore while it was well inside the region of strong wind. In the course of its propagation to the site, such a packet would experience a wind history different from what it would have experienced had the land not been there. All else being equal, the net effect would be the same as if there had been no land but also no wind for times earlier than that at which the packet had to depart the shoreline in order to reach the site at observation time. Consequently, one would expect less energy in these wave packets, even if the land had no other effect whatsoever on the wind history. In the case of Kate, of course, there were other effects, the hurricane having been considerably weakened by its encounter with the island of Cuba.

The discrepancy between maximum sea states and local winds can be explained by the sheltering effect of Cuba. This results in the wave packets making up the maximum sea state for Gloria, having experienced significantly longer histories of high winds, allowing higher sea states to develop even though the local winds at time of sea state maximum were higher during Kate. This explanation cannot account for the discrepancy between the observed maximum sea state for Gloria and the prediction of the Ross model.

Gloria was an open ocean storm with parameters falling within the range for which the Ross model should be valid, and better agreement should have been forthcoming. On the other hand, it would not have been surprising for the model to overestimate the maximum sea state for Kate,

Buoy Station 41002

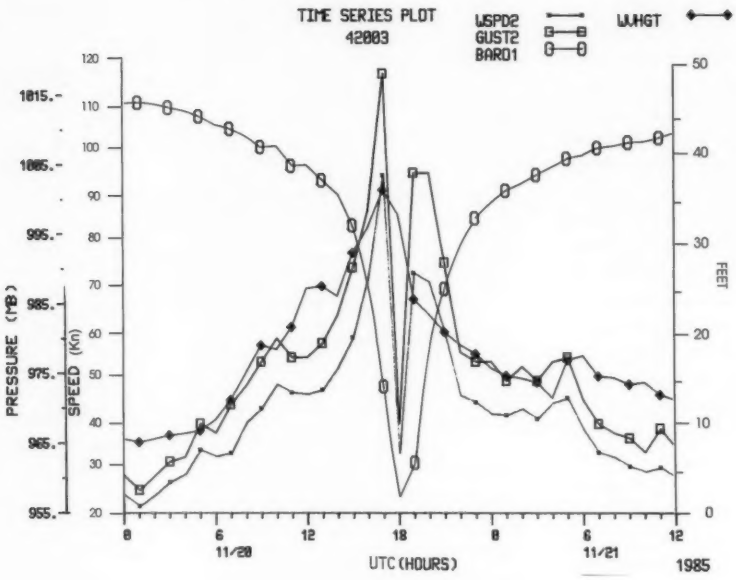


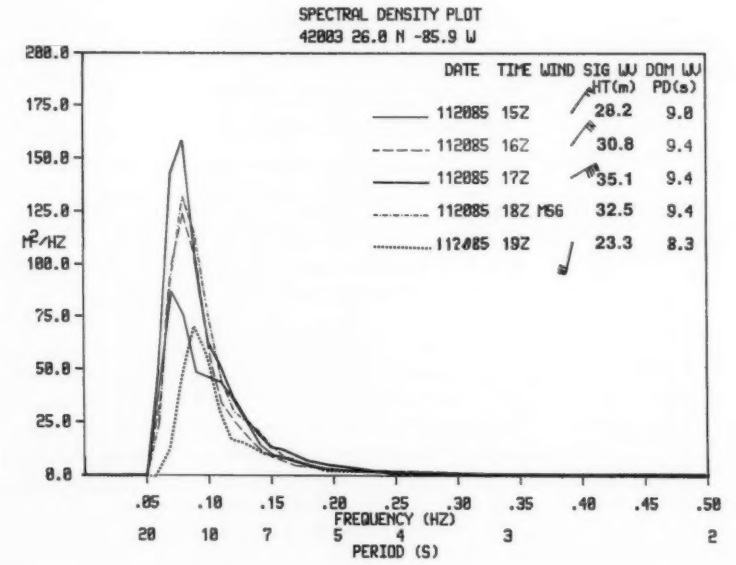


Wave Spectra

NDBC wave spectra are based on 20-minute records. The spectra cover the frequency range from 0.03 hertz to 0.40 hertz in 0.01 hertz intervals. Each 0.01 hertz frequency band has 24 degrees of freedom so that 90-percent confidence intervals are 0.66 and 1.74 multiplied by a given spectral value. Even if wave conditions are spatially homogeneous, a spectrum obtained from simultaneous measurements a few hundred feet away could have reasonably different spectral values. Likewise even if wave conditions are stationary in time, a spectrum determined from a wave record immediately before or after a given record could have reasonably different spectral values.

Buoy Station 42003





since it does not take into account the effect of sheltering coastlines; instead, the model predicted Kate's conditions very well. For now, the discrepancy remains unexplained.

NDBC began development of directional wave measurement capability in 1976. There are two operational systems deployed now and more systems will be slowly implemented. Such equipment would have provided exceedingly interesting information on the wave regimes around Gloria and Kate.

References

Gilhousen, D.B., "A Field Evaluation of NDBC Moored Buoy Winds," *Journal of Atmospheric and Oceanic Technology*, 4, 1 (1987).

Hamilton, G.D., "Severe Buoy Wave Conditions," *Mariners Weather Log*, 26, 3 (1982).

Long, R.B., "Forecasting Hurricane Waves," *Mariners Weather Log*, 23, 1 (1979).

The Western North Pacific's

Typhoons '86

– by Joint Typhoon Warning Center Staff
Guam, Mariana Islands

During 1986, some twenty-seven tropical cyclones developed , including three supertyphoons, sixteen typhoons and eight tropical storms. This is slightly below the long-term average of thirty-one. Typhoons are summarized here, while the tropical storms can be found in the appropriate issues of the Mariners Weather Log. This report is extracted from the more complete 1986 Annual Tropical Cyclone Report.

The formation of typhoon **Judy** in late January marked the start of the western North Pacific tropical cyclones for 1986. A warning was issued February 1st at 0000. Within twenty-four hours, Judy was upgraded to tropical storm intensity. Continuing to intensify, Judy reached its maximum intensity of 85 knots, with a pressure 974 millibars, at 0000 on the 5th. No deaths, injuries or property damage were reported.

Ken was the first April tropical cyclone in the Western North Pacific in five years. Ken reached typhoon intensity on the 27th. Aircraft reconnaissance revealed a compact circulation, a minimum sea-level pressure of 980 millibars and an elliptical eye. Ken's intensity peaked at 90 knots on the 28th. On the 29th, it began to weaken.

Lola is still picturesque, but decreasing in intensity at 2329Z on the 20th of May.

Lola was the first of the three supertyphoons. Lola's appearance coincided with a very destructive tropical cyclone in the southern hemisphere, Namu. Lola's appearancealso coincided with the ten-year anniversary of supertyphoon Pamela's devastating visit to Guam on May 21, 1976. It began as a disturbance in a very active monsoon trough extending from south of Guam eastward to the Marshall Islands. This was enhanced by two opposing wind flows — cross-equatorial winds provided strong southwesterly flow and the trade winds provided northeasterly flow. For several days prior to Lola's inception, destructive winds and torrential rains battered the Caroline Islands. The island atoll of Nukuoro experienced damage from thunderstorm winds of 40 knots with gusts to 60 knots.

At that time Lola was just a tropical disturbance. It was upgraded to a tropical storm on the 17th. Lola caused extensive damage to Pohnpel; the worst battering since typhoon Ophelia in 1958. By early on the 18th, Lola was a typhoon. A three-fix reconnaissance mission on the morning of the 19th confirmed the worst — explosive deepening. Lola became a 130-knot super typhoon and peaked at 1800 on the 19th when winds were estimated at 150 knots. That night it began to weaken and during

Western North Pacific Statistics

WESTERN NORTH PACIFIC TROPICAL CYCLONE DISTRIBUTION

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS
1959	0 000	1 010	1 010	1 100	0 000	1 001	3 111	6 512	9 423	3 210	2 200	2 200	31 17 7 7
1960	1 001	0 000	1 001	1 100	1 010	3 210	3 210	9 810	5 041	4 400	1 100	1 100	30 19 8 3
1961	1 010	1 010	1 100	1 010	4 211	6 114	5 320	7 313	6 510	7 322	2 101	1 100	42 20 11 11
1962	0 000	1 010	0 000	1 100	3 201	0 000	8 512	8 701	7 313	5 311	4 301	2 020	39 24 6 9
1963	0 000	0 000	1 001	1 100	0 000	4 310	5 311	4 301	4 220	6 510	0 000	3 210	28 19 6 3
1964	0 000	0 000	0 000	0 000	3 201	2 200	8 611	8 350	8 521	7 331	6 420	2 101	44 26 13 5
1965	2 110	2 020	1 010	1 100	2 101	4 310	6 411	7 322	9 531	3 201	2 110	1 010	40 21 13 6
1966	0 000	0 000	0 000	1 100	2 200	1 100	4 310	9 531	10 532	4 112	5 122	2 101	38 20 10 8
1967	1 010	0 000	2 110	1 100	1 010	1 100	8 332	10 343	8 530	4 211	4 400	1 010	41 20 15 6
1968	0 000	1 001	0 000	1 100	0 000	4 202	3 120	8 341	4 400	6 510	4 400	0 000	31 20 7 4
1969	1 100	0 000	1 010	1 100	0 000	0 000	3 210	3 210	6 204	5 410	2 110	1 010	23 13 6 4
1970	0 000	1 100	0 000	0 000	0 000	2 110	3 021	7 421	4 220	6 321	4 130	0 000	27 12 12 3
1971	1 010	0 000	1 010	2 200	5 230	2 200	8 620	5 311	7 511	4 310	2 110	0 000	37 24 11 2
1972	1 100	0 000	1 001	0 000	0 000	4 220	5 410	5 320	6 411	5 410	2 200	3 210	32 22 8 2
1973	0 000	0 000	0 000	0 000	0 000	0 000	7 430	6 231	3 201	4 400	3 030	0 000	23 12 9 2
1974	1 010	0 000	1 010	1 010	1 100	4 121	5 230	7 232	5 320	4 400	4 220	2 020	35 15 17 3
1975	1 100	0 000	0 000	1 001	0 000	0 000	1 010	6 411	5 410	6 321	3 210	2 002	25 14 6 5
1976	1 100	1 010	0 000	2 110	2 200	2 200	4 220	4 130	5 410	0 000	2 110	2 020	25 14 11 0
1977	0 000	0 000	1 010	0 000	1 001	1 010	4 301	2 020	5 230	4 310	2 200	1 100	21 11 8 2
1978	1 010	0 000	0 000	1 100	0 000	3 030	4 310	8 341	4 310	7 412	4 121	0 000	32 15 13 4
1979	1 100	0 000	1 100	1 100	2 011	0 000	5 221	4 202	6 330	3 210	2 110	3 111	28 14 9 5
1980	0 000	0 000	1 001	1 010	4 220	1 010	5 311	3 201	7 511	4 220	1 100	1 010	28 15 9 4
1981	0 000	0 000	1 100	1 010	1 010	2 200	5 230	8 251	4 400	2 110	3 210	2 200	29 16 12 1
1982	0 000	0 000	3 210	0 000	1 100	3 120	4 220	5 500	6 321	4 301	1 100	1 100	28 19 7 2
1983	0 000	0 000	0 000	0 000	0 000	1 010	3 300	6 231	3 111	5 320	5 320	2 020	25 12 11 2
1984	0 000	0 000	0 000	0 000	0 000	2 020	5 410	7 232	4 130	8 521	3 300	1 100	30 16 11 3
1985	2 020	0 000	0 000	0 000	1 100	3 201	1 100	7 520	5 320	5 410	1 010	2 110	27 17 9 1
1986	0 000	1 100	0 000	1 100	2 110	2 110	2 200	5 410	2 200	5 320	4 220	3 210	27 19 8 0
(1959-1986) AVG	0.5	0.3	0.6	0.8	1.3	2.1	4.6	6.3	5.6	4.6	2.8	1.5	30.9
CASES	15	9	18	21	36	58	128	175	157	130	78	41	866

Legend: Total for the month——6

Typhoons——3 1 2
Tropical Storms——
Tropical Depressions——

NOTE: This new compilation of 1959 through 1986 data was done after establishing a standard for the times when a tropical cyclone existed in two separate months. The criterion used follows:

1. If a tropical cyclone was first warned on during the last two days of a particular month and continued over into the next month for longer than two days, then that system was attributed to the second month.
2. If a tropical cyclone was warned on prior to the last two days of a month, it was attributed to the first month - no matter how long the system lasted.
3. If a tropical cyclone began on the last day of the month and ended on the first day of the next month, that tropical cyclone was attributed to the first month. However, if a tropical cyclone began on the last day of the month and continued into the next month for two days only, then it was attributed to the second month.

WESTERN NORTH PACIFIC 1986 SIGNIFICANT TROPICAL CYCLONES

TROPICAL CYCLONE			PERIOD OF WARNING	CALENDAR DAYS OF WARNING	NUMBER OF WARNINGS ISSUED	MAXIMUM SURFACE WINDS-KT (M/S)	ESTIMATED MSLP - MB
01W	TY	JUDY	01 FEB - 06 FEB	5	21	85 (44)	974
02W	TY	KEN	26 APR - 01 MAY	5	18	90 (46)	980
03W	STY	LOLA	17 MAY - 23 MAY	7	26	150 (77)	910
04W	TS	MAC	26 MAY - 29 MAY	4	15	45 (23)	992
05W	TY	NANCY	21 JUN - 25 JUN	4	15	80 (41)	955
06W	TS	OWEN	28 JUN - 02 JUL	5	17	50 (26)	987
07W	STY	PEGGY	03 JUL - 11 JUL	9	35	140 (72)	900
08W	TY	ROGER	13 JUL - 17 JUL	5	19	85 (44)	955
09W	TS	SARAH	30 JUL - 04 AUG	6	22	55 (28)	986
11E	TY	GEORGETTE	09 AUG - 15 AUG	7	26	65 (33)	973
10W	TY	TIP	13 AUG - 19 AUG	7	25	80 (41)	965
11W	TS	VERA #1	15 AUG - 17 AUG	3	7	40 (21)	995
11W	TY	VERA #2	17 AUG - 29 AUG	13	48	110 (57)	923
12W	TY	WAYNE	18 AUG - 25 AUG	8	29	85 (44)	956
12W	TY	WAYNE*	28 AUG - 06 SEP	10	38	90 (46)	951
13W	TY	ABBY	13 SEP - 20 SEP	8	30	95 (49)	943
14W	TY	BEN	19 SEP - 30 SEP	12	46	120 (62)	917
15W	TY	CARMEN	02 OCT - 08 OCT	7	27	100 (51)	939
16W	TS	DOM	09 OCT - 11 OCT	3	11	45 (23)	990
17W	TY	ELLEN	11 OCT - 19 OCT	8	33	80 (41)	970
18W	TY	FORREST	15 OCT - 20 OCT	6	19	110 (57)	932
19W	TS	GEORGIA	18 OCT - 21 OCT	4	15	55 (28)	983
20W	TS	HERBERT	08 NOV - 11 NOV	4	16	60 (31)	986
21W	TS	IDA	10 NOV - 16 NOV	6	22	55 (28)	986
22W	TY	JOE	18 NOV - 24 NOV	7	24	100 (51)	940
23W	STY	KIM	28 NOV - 11 DEC	13	52	140 (72)	905
24W	TS	LEX	03 DEC - 05 DEC	3	8	40 (21)	994
25W	TY	MARGE	14 DEC - 23 DEC	10	38	95 (49)	947
26W	TY	NORRIS	21 DEC - 01 JAN	11	43	90 (46)	953
			1986 TOTALS:	163 **	743 ***		

* REGENERATED
** OVERLAPPING DAYS INCLUDED ONLY ONCE IN SUM.
*** YEAR-END TOTAL DOES NOT INCLUDE TWO WARNINGS ON TY NORRIS ON 01 JAN 87.

NOTE: DISTANCE TRAVELED HAS NOT BEEN PROVIDED, BUT CAN BE COMPUTED FROM RAW DATA - SEE ANNEX A.

WESTERN NORTH PACIFIC SUMMARY

TYPHOONS

(1945-1958)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS
AVG	0.4	0.1	0.3	0.4	0.7	1.1	2.0	2.9	3.2	2.4	2.0	0.9	16.3
CASES	5	1	4	5	10	15	28	41	45	34	28	12	228

(1959-1986)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS
AVG	0.2	0.1	0.2	0.5	0.7	1.0	2.7	3.3	3.3	3.0	1.7	0.7	17.4
CASES	6	2	6	15	19	29	76	91	91	85	47	19	486

TROPICAL STORMS AND TYPHOONS

(1945-1958)

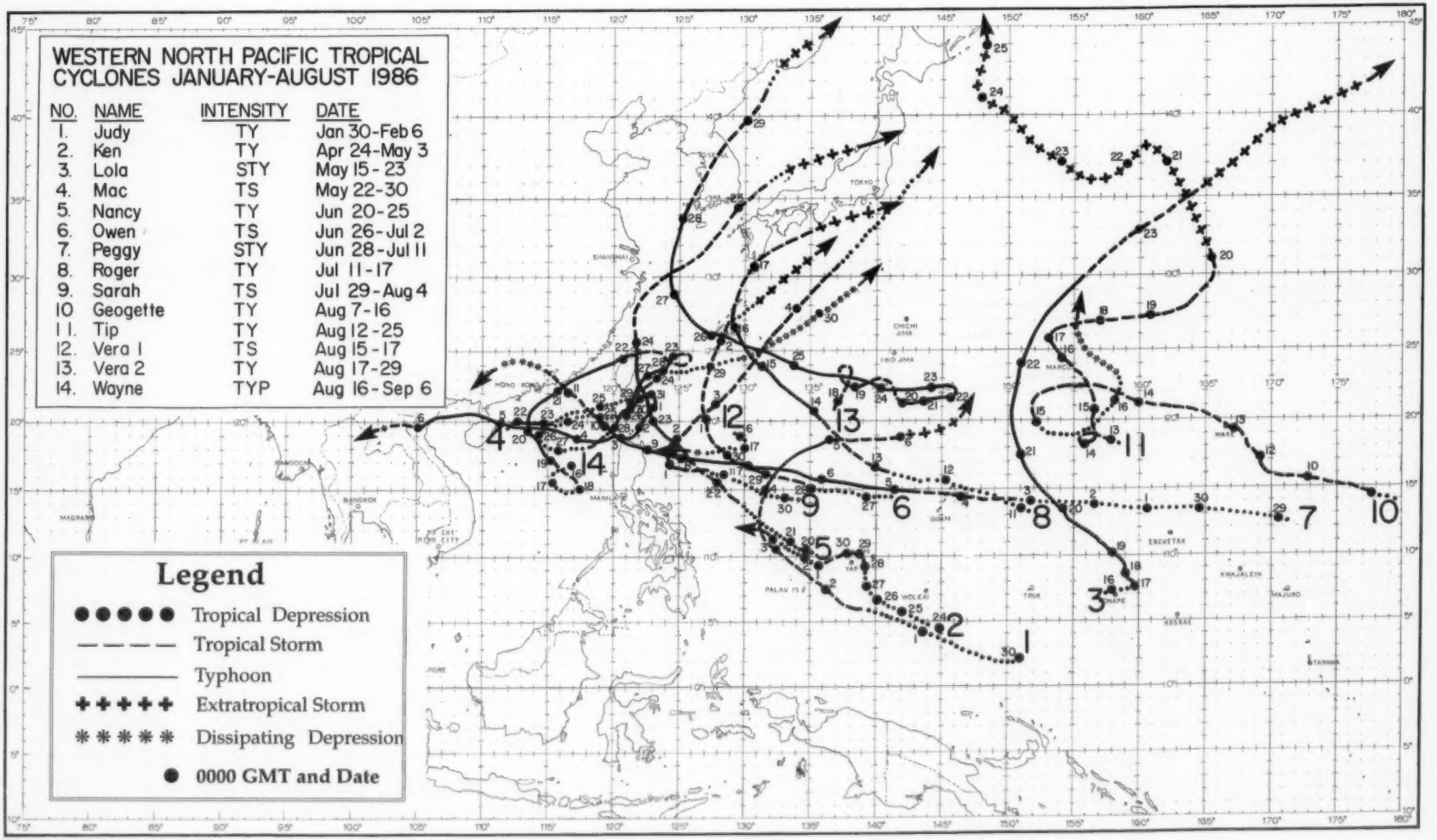
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS
AVG	0.4	0.1	0.4	0.5	0.8	1.6	3.0	3.9	4.1	3.3	2.8	1.1	22.0
CASES	6	1	6	7	11	22	42	54	58	46	39	16	308

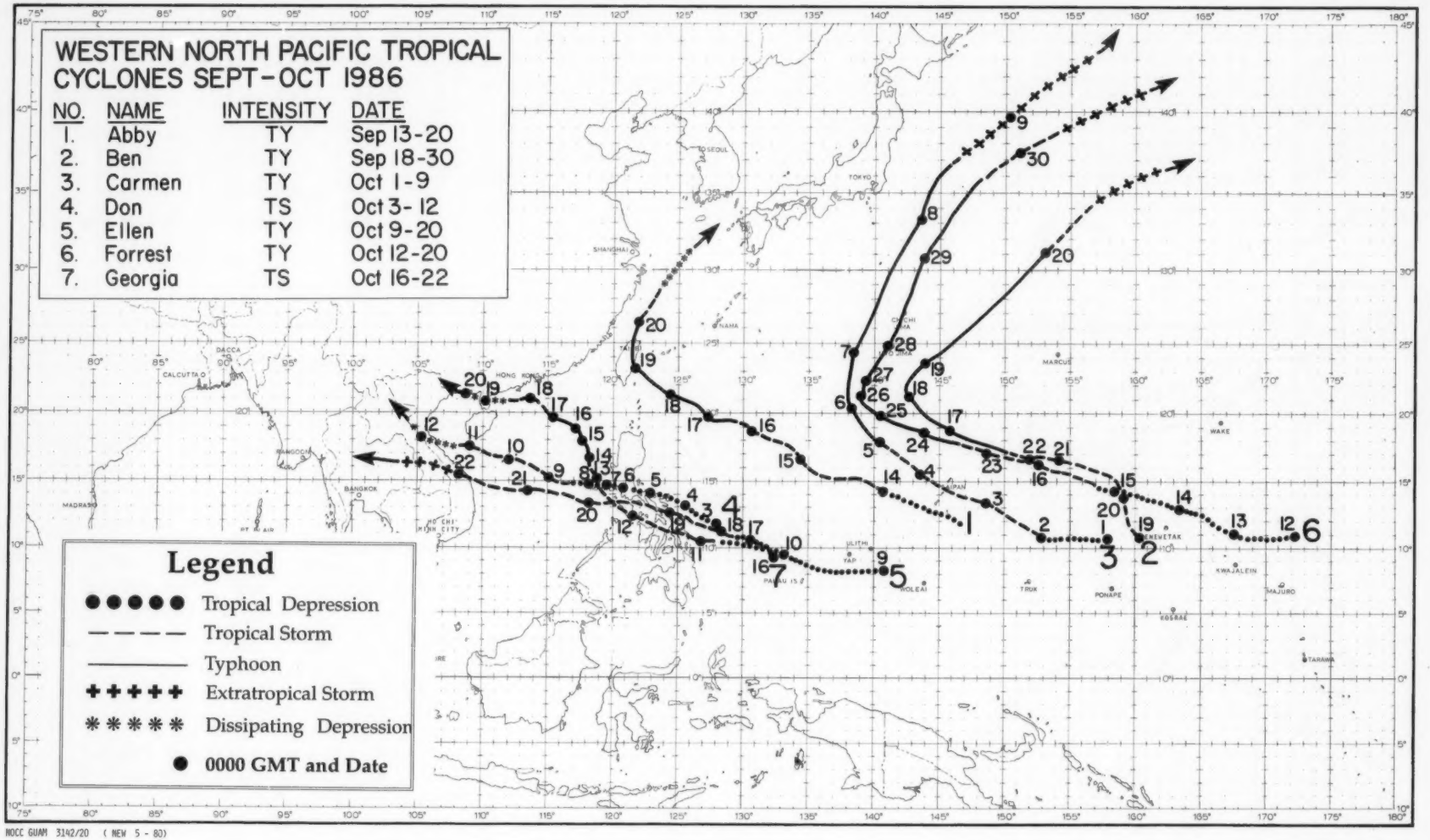
(1959-1986)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS
AVG	0.5	0.3	0.5	0.7	1.1	1.8	4.1	5.3	4.9	4.1	2.6	1.3	27.1
CASES	14	8	14	20	30	49	116	147	136	116	73	36	759

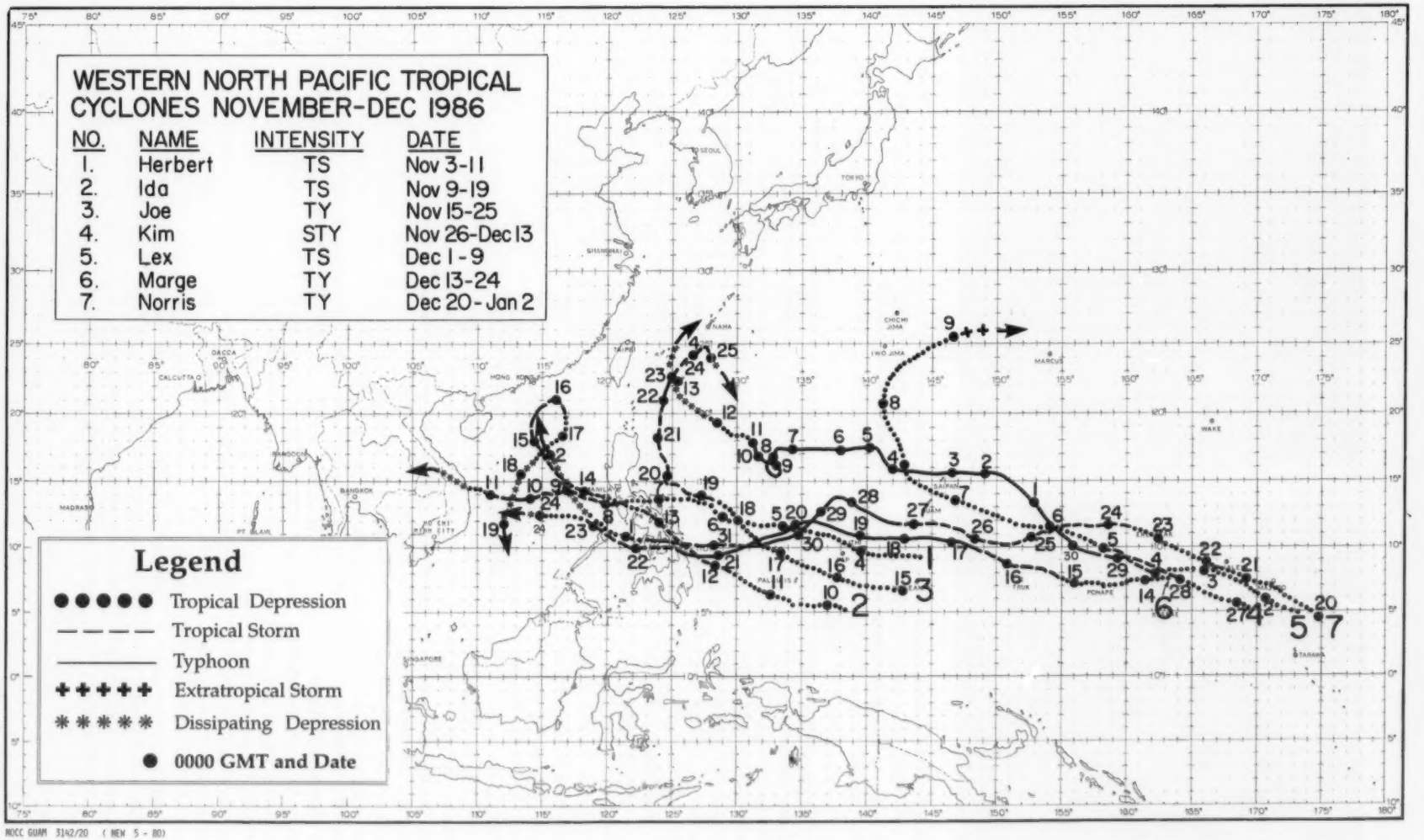
(1986)

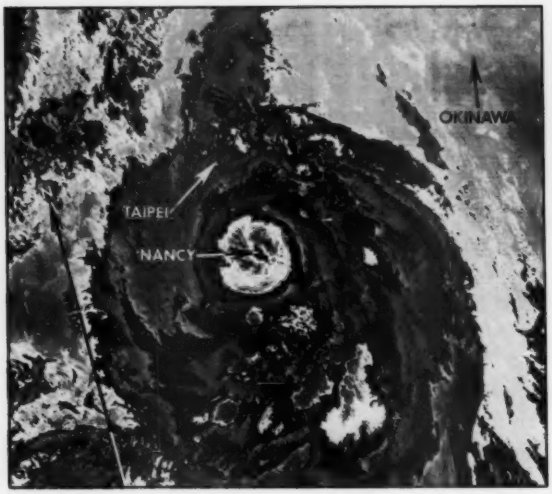
FORMATION ALERTS: 27 of 30 Formation Alerts developed into significant tropical cyclones. Tropical Cyclone Formation Alerts were issued for all of the significant tropical cyclones that developed in 1986.


WESTERN NORTH PACIFIC TROPICAL CYCLONES JANUARY-AUGUST 1986
NO. NAME INTENSITY DATE
1. Judy TY Jan 30-Feb 6
2. Ken TY Apr 24-May 3
3. Lola STY May 15-23
4. Mac TS May 22-30
5. Nancy TY Jun 20-25
6. Owen TS Jun 26-Jul 2
7. Peggy STY Jun 28-Jul 11
8. Roger TY Jul 11-17
9. Sarah TS Jul 29-Aug 4
10 Geogette TY Aug 7-16
11. Tip TY Aug 12-25
12. Vera 1 TS Aug 15-17
13. Vera 2 TY Aug 17-29
14. Wayne TYP Aug 16-Sep 6
Legend
Tropical Depression
Tropical Storm
Typhoon
Extratropical Storm
Dissipating Depression
0000 GMT and Date
TOKYO
SHANGHAI
HONG KONG
BANGKOK
MANILA
GUAM
TRUK
YAP
KOSRAE
MAJURO
ENEWETAK
KWAJALEIN
WAKE
MARCUS
CHICHI JIMA
IWO JIMA
PALAU IS
NOCC GUAM 3142/20 (NEW 5 - 80)

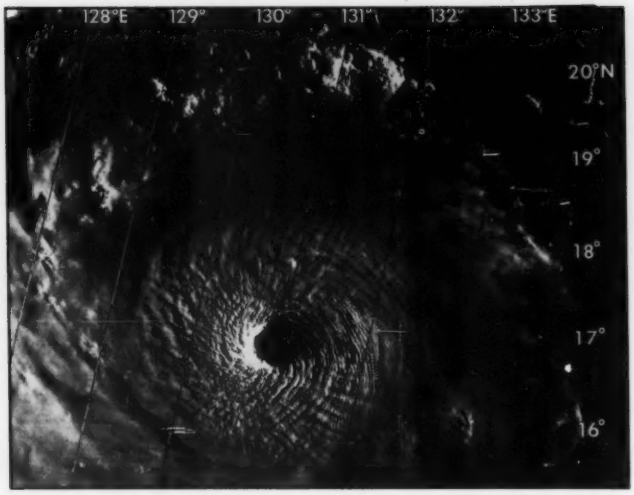


NOCC GUAM 3142/20 (NEW 5 - 80)


WESTERN NORTH PACIFIC TROPICAL CYCLONES NOVEMBER-DEC 1986
NO. NAME INTENSITY DATE
1. Herbert TS Nov 3-11
2. Ida TS Nov 9-19
3. Joe TY Nov 15-25
4. Kim STY Nov 26-Dec 13
5. Lex TS Dec 1-9
6. Marge TY Dec 13-24
7. Norris TY Dec 20-Jan 2
Legend
Tropical Depression
Tropical Storm
Typhoon
Extratropical Storm
Dissipating Depression
0000 GMT and Date
NOCC GUAM 3142/20 (NEW 5 - 80)



Specially enhanced infrared image of Nancy's eye. The gray shading, which is used in conjunction with the Dvorak enhanced infrared technique, can provide intensity estimate. (June 23 at 1428Z).



Supertyphoon Peggy at 140-kn maximum intensity at 2120Z on the 6th of July. Visual imagery courtesy H and HS Weather, MCAS Futenma.

the next few days Lola turned extratropical.

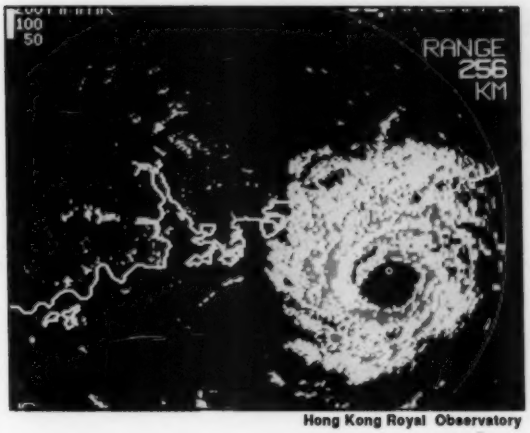
Aircraft reconnaissance flew into tropical depression 05W, on the 22d of June, and reported maximum surface winds of 60 knots. It was upgraded to tropical storm **Nancy**. Within 24 hours Nancy was a typhoon. Just prior to hitting Taiwan, Nancy's intensity peaked at 80 knots. The maximum surface wind reported from the island was 63 knots. The storm moved rapidly through the Korea Straits. South Korea received torrential rains, which inundated 22,477 acres of farmland. Twelve people were reported dead or missing, as as a result of the flooding.

On the 6th of July, **Peggy** became the second supertyphoon of the season. A few days earlier it had brushed Guam with 28-knot winds. Damage was restricted to primarily power poles and crops. Rota, Tinian and Saipan experienced extensive crop damage. From 2352 on the 4th to 2040 on the 6th, Peggy's pressure dropped from 973 to 900 millibars. This corresponds to a drop of approximately 1.6 millibar per hour, which is classified as rapid deepening. The supertyphoon slammed into Luzon with 95-knot winds. Newspapers reported 93 people died, 16 missing, and damage estimated at $2.5 million. Also, two people lost their lives in southern Taiwan. After crossing northern Luzon, Peggy continued to weaken. It made landfall over southern China, 80 miles east of Hong Kong on the 11th, with an intensity of 55 knots. Flooding occurred across southern China and over 200 people were reported dead.

During all stages typhoon **Roger** remained small. Weather Officers flying into Roger consistently reported the diameter of the center as 1 to 4 miles. The first warning was issued on the 13th of July. Although Roger passed 45 miles east of Okinawa, the effect was minimal due to its size. Peak gusts of 43 knots were reported and the northern part of the island received about 1 inch of rainfall. Approximately 4000 tourists were stranded briefly at Naha Airport during the day. There were no reports of injuries of significant damage on Okinawa or to shipping.

Typhoons **Georgette** and **Tip** circled one another in a complex binary interaction. Georgette was a rare storm that traveled from the eastern North Pacific across the central region and became a typhoon in the west. During its 2-week life Georgette traveled nearly 5,600 miles. After reaching tropical storm strength on the 3d of August and then weakening, Georgette maintained its identity as it crossed the dateline. It was a typhoon by the 10th and moved over Wake Island on the 13th, where winds of 43 knots were recorded. Georgette maintained minimal tropical storm intensity until after it had circled typhoon Tip. Tip, which had started some 250 miles southwest of Wake Island on the 9th, reached tropical storm strength by the 12th. Late on the 13th the two storms were about 400 miles apart; Tip was capturing the low-level inflow of Georgette and becoming more intense. Georgette circled Tip in a counterclockwise motion, while Tip made a small counterclockwise loop. During the later part of the interaction Tip peaked at 80 knots, early on the 16th. The following day it headed northeastward and began to weaken as it turned extratropical. No reports of damage or fatalities were received.

Typhoon **Vera,** a classic "monsoon depression," formed in the most intense, extensive monsoon trough in the region since 1974. It was later determined that Vera was actually two systems: the first stabilized only briefly, reached tropical storm intensity then dissipated in the central Philippine Sea; the second formed at the northeast periphery of the monsoon trough, developed slowly and reached typhoon intensity before crossing Okinawa. The second stage reached a peak of 110 knots with a pressure of 923 millibars on the 21st of August, just prior to turning toward Okinawa The island experienced only slight damage. One fisherman was killed. Kadena AB recorded peak wind gusts of 84 knots. High seas, however,



Hong Kong Royal Observatory

Digitized radar presentation of typhoon Wayne at 2140Z on the 20th of August.

Captain Susan K. Watters

Inside typhoon Carmen at 2355Z on the 4th of October. This is the scene from an aircraft recconnaissance mission.

placed several ships at sea in distress. In Shanghai, seven people were killed and 28 injured. The New China News Agency reported more than 500 homes were destroyed and that more than 3,000 vessels sought shelter. On Cheju, 28 houses were destroyed. In South Korea, six people were killed and over $1 million worth of damage was reported.

Typhoon **Wayne**, in August, was one of the longest-lived tropical cyclones in the 28-year history of the Joint Typhoon Warning Center. Wayne was a small system that remained in the northern South China and western Philippine Seas. Its track includes three loops and a figure eight. Wayne also dissipated and then regenerated. The storm reached a peak of 90 knots at 0000 on the 4th. Wayne then moved south of Hong Kong, north of Hainan and across the northern Gulf of Tonkin before dissipating over southern China. As a result, 52 people were reported killed and 97 people injured in Taiwan. On Luzon, 19 people were killed and hundreds injured. In Vietnam, dozens of people were killed in addition to the hundreds injured.

Typhoon **Abby** developed in September, moved northwestward and eventually recurved around the subtropical ridge. While forming, Abby gave an indication that it might develop rapidly, however, it caused little damage when it passed 30 miles south southwest of Guam. The storm reached its maximum of 95 knots at 1200 on the 18th. Twelve hours later it swept past Taiwan with 90-knot winds and torrential rains. As a result 13 people were killed, while crop and property damage were estimated at $81 million.

Typhoon **Ben** resulted in the loss of 13 fishermen from Saipan, who had sought shelter, as it passed by Pagan in the northern Marianas. The tragedy was that, although the warning was accurate, the captain apparently decided to leave for the northern islands anyway. Ben reached typhoon intensity at 0900 on the 23d of September just 5 hours before passing 20 miles south of Pagan Island. It continued to intensify through 0000 on the 25th when maximum sustained winds peaked at 120 knots with a minimum pressure of 917 millibars.

Typhoon **Carmen** was the first of five October tropical cyclones. It followed a track between Guam and Saipan. It was slow developing, but deepened rapidly prior to recurvature. Winds from Rota were 35 knots with gusts to 53 knots and Guam received 10 to 11 inches of rain. Carmen reached its peak of 100 knots with gusts to 125 knots at 1800 on the 5th. Afterward, cooler, drier air associated with a mid-latitude trough, east of Japan, was entrained into the system.

Typhoon **Ellen** followed close on the heels of Carmen. It became a tropical depression on the 9th of October. After reaching a peak intensity of 80 knots on the 24th, the vertical shear from the westerlies remained weak and Ellen maintained tropical storm intensity almost until landfall, northeast of Hainan.

Forrest, in October, was the second tropical cyclone to begin east of the dateline and move into the west. Forrest was a small, compact system. It peaked at 0000 on the 17th when winds reached 100 knots. Two hours before, the island of Agrihan bore the brunt of the typhoon as it passed 10 miles to the south. Fortunately the island's 25 residents received no injuries even though only one building was left standing. On the 21st the Navy and Coast Guard joined forces and airlifted one thousand pounds of canned food, medical supplies and a two-way radio to the islanders.

Joe reached typhoon intensity between 1800 on the 19th and 0000 on the 20th of November. A short time later a ragged eye became visible and the storm continued to intensify. It peaked at 100 knots at 0600 on the 21st . The storm moved northward around the western edge of the subtropical ridge and the vertical shear began to weaken it.

Supertyphoon **Kim** was a "midget" storm that produced sustained winds of 135 knots with gusts to 165 knots and attained a minimum sea-level pressure of 905 millibars. It was the season's fourth November tropical cyclone and the third supertyphoon. Kim was the first December supertyphoon since Opal in December 1964. Kim began, innocently enough, as a broad, poorly organized area of convection near the dateline on the 26th. Reconnaissance on the 29th reported surface winds of 80 to

Previous photo showed Carmen from the air and here is the ground version on Guam on October 3.

Guam Publications Inc.

85 knots. Kim reached supertyphoon strength by 2100 on the 2d. The following day it passed about 18 miles north of Saipan, leaving the island without electricity and water; damage was estimated at $15 million with one fatality.

Marge was a mid-December tropical cyclone that originated just east of the Marshall Islands. It became a tropical storm on the 15th and was a typhoon by 1200 the following day. A few days later it passed about 160 miles south of Guam but left no significant damage. On the 21st the ***USS Proteus*** passed with 60 miles of the center and experienced 50-knot winds; at the time winds close to the center were running 80 knots.

During Marge's lifetime, aviation history was made. The ***Voyager***, a light-weight, graphite fiber-bodied aircraft, piloted by Burt Rutan and Jeana Yeager, departed Edwards Air Force Base, California, on the 5th of December in an attempt to circle the globe on a single tank of fuel. Initially , the flight plan routed ***Voyager*** just north of Australia on the Pacific leg. However, a very active monsoon trough forced a change. After consulting with JTWC, the plane was rerouted north of the Marianas. While it winged its way westward, Marge continued to intensify. Although, at one point it appeared the ***Voyager*** might have to terminate its mission, the low-level winds into Marge's center actually aided in the flight. Despite some moderate turbulence, between two of Marge's spiral bands, the plane picked up tail winds of 35 knots, was able to reduce fuel consumption and sped onward to complete a successful mission.

The final typhoon of 1986, Norris, began as Marge was moving through the Caroline Islands. Norris was first detected south of the Marshall Islands on the 17th of December. It moved west northwestward and intensified, passing south of the southern Marianas, the day after Christmas. Guam recorded a wind of 50 knots and some local flooding. Early on the 27th Norris reached typhoon strength. Minimum sea level pressure dropped to 953 millibars with winds near 90 knots late on the 28th. The storm moved into the South China Sea as a tropical storm late on the 30th.

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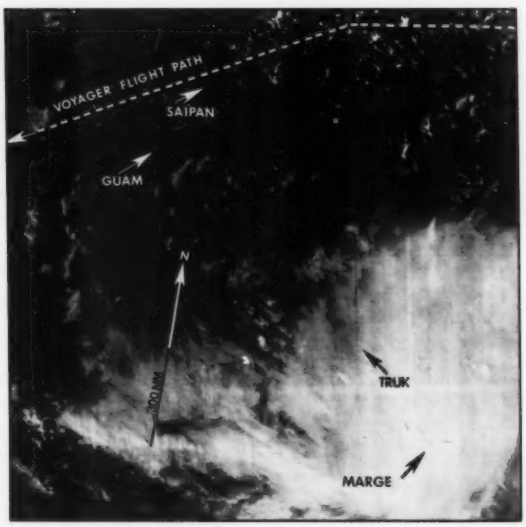
One of the many downed telephone poles in Garapan , the major city of Saipan, in the aftermath of Kim.



*Tropical storm Marge passed south of Guam just 9 hours before **Voyager** left on the start of its record-setting flight. Photo on December 15 at 0517Z.*

marine observation program

— by Martin S. Baron
National Weather Service
Silver Spring, MD.

Questions and Answers

The summer 1987 edition of the Mariners Weather Log (Mail Bag) contained a letter with many interesting questions concerning weather observing and the ship's synoptic code. The questions are repeated below along with, what I hope are, understandable answers. I welcome comments and questions, which may be raised by this dialogue. Many thanks to 3d Officer Ray Conrady of the U.S. Lines for his letter.

Sea Temp— we use the temperature from the log book from the end of the last watch (as opposed to calling the engine room & asking for it) so the sea temp scan be as much as 4 hours off.

All elements of the ship's synoptic code should be taken as close to the reporting hour as practicable. These elements can change rapidly — even over just a few minutes. Currents, eddies, mixing, air temperature changes and upwelling can all cause appreciable changes in the sea water temperature. Scientists use this data for a wide variety of studies and products. Please call the engine room or use a sea water dip (available from your PMO) to obtain an up-to-date reading. Incidentally, your vessel's sea water thermometer should be checked and calibrated if needed, once each year. (Contact PMO for assistance.)

LA & LO — usually put down 1/2 hr or so before reporting time.

Use the latest ship's position data that is available to you. This should be no more than one-half hour from reporting time. If it is, you should obtain new coordinates.

h — height of cloud — we use the formula (DRY C - DP C x 133 = ht) and as you know, this doesn't always give a correct estimate.

The first step in determining cloud height is to identify the cloud type and refer to its normal height range. See Table 1.

The heights in the table are for temperate regions or middle latitudes. These heights will be higher in the tropics and lower in high latitudes. Similarly, heights will be higher in summer and lower in winter. The appearance of the clouds, such as motion visible in the cloud base and the size of cloud elements, gives some indication as to how much higher or lower it is than average. For very low clouds, compare the apparent speed of movement with the surface wind. When the cloud moves rapidly with light or moderate surface winds, it is near the surface, while slow movement with strong surface winds indicates a higher base.

The height of cumuliform clouds(cumulus, cumulonimbus, stratocumulus formed by turbulence, and altocumulus) can be approximated by using the

Cloud Type	Abbreviation	Typical Heights	
Cirrus	Ci	High	5-13-km
Cirrostratus	Cs	(Ch)	(16,500-45,000 ft)
Cirrocumulus	Cc		
Altostratus	As	Middle	2-7 km
Altocumulus	Ac	(Cm)	(6,500-23,000 ft)
Stratus	St	Low	below 2 km
Stratocumulus	Sc	(CL)	(6,500 ft)
Nimbostratus	Ns		
Cumulus	Cu		
Cumulonimbus	Cb	Vertical development	

Table 1. Temperate Zone cloud types with typical heights above ground.

known relationship between air temperature and dewpoint. In meters and degrees Celsius, air temperature minus dewpoint temperature x 133 gives the cloud height. In feet and degrees Fahrenheit, convective cloud height is roughly air temperature minus dewpoint temperature x 236. Skill in height estimates can be obtained by making practices estimates on cumuliform clouds using these formulae. While in port your PMO or local Weather Service Office can check practice estimates.

T_d (Dry Bulb) & T_w (Wet Bulb) - we measure to the nearest degree F, use wet/dry thermometers mounted on the wings of the bridge (as opposed to the furnished sling, or electric psychrometer) and if we're conscientious we use the reading on the coolest side of the ship.

All temperature reading should be taken in the shade and reported in Celsius, degrees and tenths. If the tenths value is not available, use a slash (1) in the tenth column of the weather message. To convert from Fahrenheit to Celsius, use the relation **C = 5/9 (F-32)**. Any thermometers of suitable accuracy can be used, but these must be mounted in the shade. A shelter that blocks out the sun and permits air to freely pass through (ventilation) is generally used. Ventilation is extremely important for both the wet bulb and dry bulb readings. Air must be able to sweep past the wet bulb for water to evaporate and cool the bulb. For the dry bulb reading, insufficient ventilation can cause the air in the shelter to heat up — resulting in a bad reading. By using the hand-held sling psychrometer, you need not worry about inadequate ventilation or shade.

Vs—ships speed—we never are sure what to do if the speed is between 20 and 21 knots.

This is an average speed over a three hour period. To determine the proper code figure (0-9) to use, you should round off the speed to the nearest whole number. A speed of 20.5 knots should be rounded up to 21 knots or code figure 5. See Table 2.

VS

Table 2
Ship's average speed made good during the three hours preceding the time of observation

Code figs.	Average Speed	Code figs.	Average Speed
0	0 knots	5	21 to 25 knots
1	1 to 5 knots	6	26 to 30 knots
2	6 to 10 knots	7	31 to 35 knots
3	11 to 15 knots	8	36 to 40 knots
4	16 to 20 knots	9	Over 40 knots

Also, we're never sure what to do regarding wind speed or direction, or cloud type or height when it's so dark that we can't see anything — do we make a vague guess or leave it blank?

Estimating wind speed and direction from a moving ship is no easy task, even in daylight when the state of the sea can be used as a guide. In complete darkness, if conditions are safe for you to go on deck, wind estimates can be made by facing into and feeling the wind "head-on." Unlike wind estimates based on the sea state this method provides an apparent wind — effects of the ship's motion must be removed before reporting to obtain true wind. Wind direction and speed, along with the amount of sky cover — **"Nddff"**, form a mandatory group which cannot be left out of the weather message. If you are unable to estimate these parameters use slash marks. The first six groups of the weather message, beginning with your ship's call letters (first group) are mandatory, and must be included in the report. All remaining groups, starting with **IS_nTTT** are optional—if not available, they need not be sent, and can be left blank or skipped over.

Similarly, use slash marks when cloud type or height cannot be determined. If none of the elements in the group **"8 N_h C_L C_MC_H"** are available, the group should not be included in the weather message (an optional group). If part of an optional group is available, report what you can, and use slashes for the missing data. Of course, we strongly urge you to observe and report all elements of the **Ship's Synoptic Code.**

Also, as you know, we seldom put down transmission details. I have attempted to do this on some ships and the cooperation has always been nil.

There are two places on the observing form (B-81 or old 72-1A) for transmission information. On the front side, second to last column from the right is space for the call letters of the relay station and for the time the transmission was completed. By completing this column, you are confirming that the report was actually sent. It is **extremely** important to know which radio station or ground station has received your message when we attempt to track down missing or misrouted data. This is also important for your PMO to know as he reviews the forms after mail-in. On the reverse side is space to record any communication difficulties you may have experienced. To correct any problems that may occur, we must have a complete description. Please record these difficulties as they occur and bring to the attention of your PMO for corrective action.

New Jacksonville PMO

Lawrence D. (Larry) Cain has been selected as the new PMO at Jacksonville, Fl. Larry was born and grew up in Utica, NY. A 20-year Navy Veteran, he enlisted at age 17, serving at sea aboard Radar Picket Escorts, Amphibious Assault Ships and Aircraft Carriers. He was stationed ashore at installations in the continental U.S. and overseas. Larry has worked as a Weather Observer, Upper Air Observer/Supervisor, an ASW Environmental Systems Technician, an Aviation/Area Forecaster and in the Navy Ship Visitation Program. After retiring from the Navy in 1981, Larry joined the National Weather Service at WSO Galveston, TX as a Weather Radar Specialist. Larry and his 9-year old daughter Colleen reside in Orange Park, Fl.

Obituary

We were saddened by the very sudden death of Felix V. Flara the Marine Observation Specialist in Anchorage, Alaska on June 24th of this year. Felix or "Fel," as he was known, passed away while recovering from heart bypass surgery at Providence Hospital in Anchorage.

Fel had lived and worked in Alaska for the past 23 years. He began his career with the National Weather Service at Barter Island. He then transferred to the Weather Service Forecast Office in Anchorage where he worked as the communications supervisor and he served as a temporary relief at several of the Weather Service Offices in the state. He transferred to the Weather Service Office in Juneau and finally, in 1975, he moved to the Alaska Region Headquarters in Anchorage as the Marine Observation Specialist where he stayed until his death.

Services were held in Anchorage on June 27 for Fel. He was buried in Beaver, Pennsylvania, near Pittsburgh, where he was raised.

MARINERS WEATHER LOG

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PMO report

—by Bob Collins
National Weather Service
Chicago, IL.

Sailing's Top Gun — The Mackinaw

For 75 years now, sailboats have set off on the 333-mile Mackinaw Race, on Lake Michigan, trying to break the record set back in 1911. That's when the steel schooner ***Amarita*** set the record of 31 hours, 14 minutes, and 30 seconds. And, even at that, she didn't win the race, as they used a handicap system that made the smallest boat, the ***Movoureen,*** the winner. Her adjusted time was 28 hours, 31 minutes and 15 seconds.

As Port Meteorological Officer for the National Weather Service in Chicago, I was given the pleasure, in July, of sailing on the ***USCG Cutter Mackinaw.*** Captain Litteken and his fine crew made me feel right-at-home and extended every hospitality.

Starting the race. Just one group of 10.

The weather forecast for the 18th and 19th called for south to southwest winds at speeds of 15 to 20 knots. The stage was set for a very fast race. Once all the sailboats were underway we began the chase in earnest. The schedule called for the ***Mackinaw*** to overtake the boats and anchor off Manitou Island on Sunday. However, the winds stayed up during the night and the boats cut a fast pace through the 1-to 3-foot waves. This delighted the crews, but such a fast pace made it necessary to by-pass Manitou Island and press on in an effort to catch the racers. As it turned out, we only caught some of the smaller, slower sailboats.

As the weather liaison for the race, I found it helpful to use my NOAA Weather Radio to keep abreast of the changing weather conditions and to update Captain Litteken and his crew. During that time, I monitored the Quartermasters as they took the weather observations. The Quartermasters were very capable and handled themselves in a professional manner. However, a problem developed when attempting to transmit the weather data via the Coast Guard land stations. The high winds and the fast pace of the race also created a few side effects. None of the weather observations taken were able to be transmitted because of higher priority radio traffic. The same weather conditions that made for the fast race also took a toll on the sailboats. In all, 22 boats were forced out of the race. Many had broken rudders, some suffered damaged booms and even a broken mast. This kept the radio very busy handling distress calls, which took priority over weather. As a result, some frustration was encountered.

A new record was set at a little under 26 hours by the new 'Top Gun" of sailing, the Pied Piper. The weather had held for the race. We were lucky, for a change was in the offing. As we headed back out to pick up a few members of the race committee from the lighthouse at Gray's Reef, the weather began to take on a different attitude. Over the land, west of Gray's Reef, a line of thunderstorms, was building rapidly. A severe thunderstorm watch was in effect and the Captain was briefed and cautioned of the rapid development. The anvil of the oncoming storm drew across the summer sky, and a roll cloud began to form at the base. Conditions drew more ominous by the minute. As the roll cloud grew larger, it clearly marked the leading edge of the colder air and strong winds.

As we discussed the situation the Captain of the ***Mackinaw*** encouraged his crew to extricate the remaining people from the lighthouse with great haste, although his words that were a little more expressive and to the point. Just as the last of the people

were onboard the winds became utterly still; not a breath of air. As the roll cloud approached, (front and back cover) we could see a telltale line on the water that indicated the exact location of the wind shift and colder air. As suddenly as things grew still, the wind snapped back to life, shifted to the west northwest and picked up to 35 knots. We were lucky. We had experienced the weaker northern portion of the storm. Conditions were much worse, farther south. At the extreme southern end of the storm we could see what appeared to be a wall cloud, that isolated lowering of a cloud base that earmarks potential tornado development. While monitoring the NOAA Weather Radio, we heard that farther south, near Traverse City, wind speeds had reached 70 miles per hour. Two boaters, not affiliated with the race, had drowned while sailing near shore and there were numerous reports of power lines and trees downed. We also heard reports of two tornado sightings.

The Value of Prompt Reporting

It is with regret and haste that I write this letter to you; regret that such a small understanding could lead to the following circumstances and haste in order that you will get this report before you form your own opinions from reports in the world press, for I am sure that they will tend to over dramatise the affair.

We had just picked up the pilot and the apprentice had returned from changing the "G" flag tor the "H" and, it being the first trip, he was having difficulty in rolling the "G" flag up. I therefore proceeded to show him how. Coming to the last part, I told him to "let go." The lad, although willing, is not too bright, necessitating my having to repeat the order in a sharper tone.

At this moment the Chief Officer appeared from the Chart room, having been plotting the vessel's progress, and, thinking that it was the anchors that were being referred to, repeated the "let go" to the Second Officer on the forecastle. The port anchor, having been cleared away but not walked out, was promptly let go. The effect of letting the anchor drop from the "pipe" while the vessel was proceeding at full harbour speed proved too much for the windlass brake and the entire length of the port cable was pulled out "by the roots". I fear that the damage to the chain locker may be extensive. The braking effect of the port anchor naturally caused the vessel to sheer in that direction, right towards the swing bridge that spans a tributary to the river up which we were proceeding.

The swing bridge operator showed great presence of mind by opening the bridge for my vessel. Unfortunately, he did not think to stop the vehicular traffic, the result being that the bridge partly opened and deposited a Volkswagon, two cyclists and a cattle truck on the foredeck. My ship's company are at present rounding up the contents of the latter, which from the noise, I would say were pigs. In his efforts to stop the progress of the vessel, the Second Officer dropped the starboard anchor, too late to be of practical use, for it fell on the swing bridge operator's control cabin.

After the port anchor was let go and the vessel started to sheer, I gave a double ring Full Astern on the Engine Room Telegraph and personally rang the Engine Room to order maximum astern revolutions. I was informed that the sea temperature was 53 degrees and asked if there was a film tonight; my reply would not add constructively to this report.

Up to now I have confined my report to the activities at the forward end of the vessel. Down aft they were having their own problems.

At the moment the port anchor was let go, the Third Officer was supervising the making fast of the aft tug and was lowering the ship's towing spring down onto the tug.

The sudden braking effect on the port anchor caused the tug to "run in under" the stern of my vessel, just at the moment when the propeller was answering my double ring Full Astern. The prompt action of the Third Officer in securing the inboard end of the towing spring delayed the sinking of the tug by some minutes, thereby allowing the safe abandoning of the vessel. It is strange, but at the very same moment of letting go the port anchor there was a power cut ashore. The fact that we were passing over a "cable area" at that time might suggest that we may have touched something on the river bed. It is perhaps lucky that the high tension cables brought down by the foremast were not live, possibly being replaced by the underwater cable, but, owing to the shore blackout, it is impossible to say where the pylon fell.

It never fails to amaze me, the actions and behavior of foreigners during moments of minor crisis. The pilot, for instance is at this moment huddled in the corner of my day cabin, alternately crooning to himself and crying after having consumed a bottle of gin in a time that is worthy of inclusion in the Guinness Book of Records. The tug captain, on the other hand, reacted violently and had to be forcibly restrained by the Steward, who has him handcuffed in the ship's hospital, where he is telling me to do impossible things with my ship and my crew.

I enclose the names and addresses of the drivers and insurance companies of the vehicles on my foredeck, which the Second Officer collected after his somewhat hurried evacuation of the forecastle. These particulars will enable you to claim for the damage that they did to the railings of the No. 1 hold.

I am closing this preliminary report, for I am finding it difficult to concentrate with the sound of police sirens and their flashing lights.

It is sad to think that had the apprentice realised that there is no need to fly pilot flags after dark, none of this would have happened.

For the weekly Accountability Report I will assign the following Casualty Numbers 750101 to 750199 inclusive.

Yours truly,

Master

beyond the rainbow

--by William R. Corliss
P.O. Box 107
Glen Arm, MD 21057

" Unusual natural phenomena at sea "

Auroras are luminous displays of poleward skies in the Northern and Southern Hemispheres. The repertoire of "normal" auroral displays ranges from an unimpressive, dull-greenish glow just tinting the northern horizon to kaleidoscopes of flickering red, yellow, and bluish flames and arches that fill half the heavens. The convoluted, eerie draperies, the silently flashing displays, and the cavorting flames we call the Merry Dancers grip the modern beholder and doubtless inspired awe and legend in primitive man.

Despite modern research, with spacecraft and instrumented rockets, the auroras have not yielded up all their mysteries — even the "normal" auroras. Auroras are loosely associated with solar activity and geomagnetic storms, so we surmise that gusts of electrically charged particles emitted by the sun (the solar wind) help in some way to set fire to the polar heavens. Beyond these generalities, there is much we do not understand. In particular, anomalies of abnormal auroras reveal even deeper layers of ignorance about one of Nature's most spectacular manifestations.

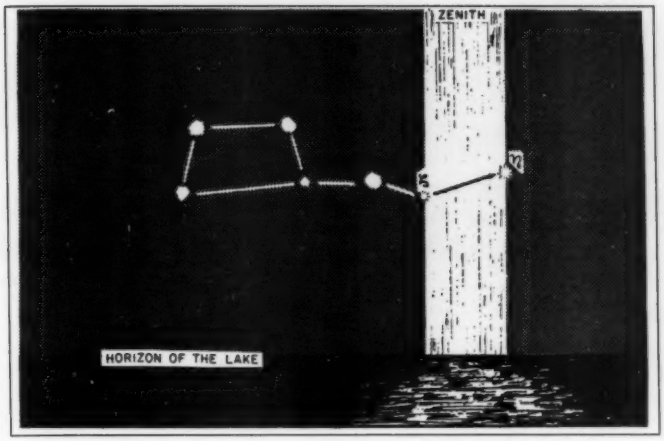
Aurora-like phenomena of uncommon form, such as those that brush the starlit sky with misty parallel bands, pose serious problems of explanation. Why the geometrically arranged bands? Are there regularly spaced conduits in the upper atmosphere for solar electricity to flow or is there a regular sea of gravitational waves in the upper atmosphere? Next, how do some rare auroras seem to approach the earth's surface, even to the point of engulfing observers in luminous mists? Conventional wisdom has it that all auroras weave their luminous magic above the 80 kilometer altitude. The abundant records of auroral "fogs," the crackling and hissing sounds, and the occasional acrid odor of ozone demonstrate that some auroras may actually record the slow discharge of terrestrial electricity to the upper atmosphere. It is almost as if a temporary hole had been punched in the planet's magnetic bottle, short-circuiting the earth to the solar-system dynamo, the sun. There are also puzzling observations linking auroras to daytime cloud formations, thunderstorms, earthquakes and mountain-top glows. That the earth is electrically active cannot be denied; it is part of an enveloping cosmos seething with energy.

"What could cause an electric-blue, all-sky flash or expanding bubbles of ghostly light many times the size of the moon?"

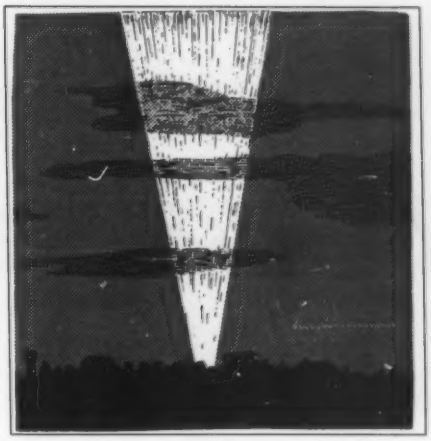
Auroras, though frequently strange and mystifying, are accepted denizens of the night skies, but there exist even stranger luminous displays that may or may not be related to auroras. What could cause an electric-blue, all-sky flash or expanding bubbles of ghostly light many times the size of the moon? What brightens the entire sky to the point where print can be read outdoors at midnight? For want of a better category, such phenomena are included with anomalous auroras.

Auroral Pillars: Natural Searchlights

Auroral pillars are isolated, often breathtaking, white-to-greenish-white shafts of light 1-10° wide extending from the horizon to near and occasionally past zenith. They usually appear in the eastern or western horizon, well away from the zone where



A straight-sided auroral pillar rising from the Bay of Toronto.



A fan-shaped auroral pillar over England.

auroral activity normally occurs. The pillars or beams may remain visible from a few minutes to over an hour, drifting slowly north or south. Wavelets of light may seem to rush up and down the filmy but well-defined beam. Both straight-sided and fan-shaped pillars are known.

Modern land observers of the night sky often see beams of light rising from the horizon. Investigation almost always proves them to be searchlights at shopping centers or some other artificial illumination. In this environment, it is not surprising that there are few modern observations of auroral pillars and that most of the scientific discussions regarding their origin are confined to the older literature.

Examples of Auroral Pillars

November 3, 1934. Liverpool, England "....about 8 o'clock, a singular luminous appearance was seen in the heavens commencing near the western horizon and after extending through the meridian of the heavens, finally losing itself near the brilliant planet Jupiter...It presented the aspect of a beauteous transparent zone of light, of near equal width, from six to seven degrees...The stars were distinctly visible through its filmy structure and here and there a thin vapoury cloud crossed it at right angles."

May 8, 1837. Bay of Toronto, Canada. R.H. Bonnycastle describes a straight-sided auroral pillar, "...my attention whilst regarding the heavens was forcibly attracted to the sudden appearance due east of a shining broad column of light...I was convinced that the meteor was an effluence of the sky, as I now saw it extend upwards from the eastern water horizon line to the zenith, as a well-defined, equal, broad column of white strong light, resembling in some degree that of the aurora, but of a steady brightness and unchanging body..." The pillar moved slowly northward disappearing in the northeast ten minutes after the first sighting.

"Of all the observations of auroral pillars, the extraordinary beam of light appearing in the evening sky on March 4, 1896, evoked the most discussion and scientific controversy".

March 4, 1896. Great Britain. Of all the observations of auroral pillars, the extraordinary beam of light appearing in the evening sky on March 4, 1896, evoked the most discussion and scientific controversy. Seen from all over the British Isles, the beam arose bright and sharply defined from a bank of clouds on the western horizon in the early evening. Its initial location was almost coincident with the axis of the zodiacal light, and it pointed along the ecliptic. The March 4 beam, however, moved appreciably southward while in view. A comet was suggested when it became obvious that the phenomenon could not be the zodiacal light. However, the pillar's sudden appearance and disappearance upset that theory. Finally, the general scientific consensus settled on an auroral beam. Depending upon the location of the observer, the beam was straight-sided, fan-shaped, or pointed at both ends. Its duration varied likewise, from a few to many minutes. Some saw lesser beams nearby; others thought they saw transitory projections perpendicular to the beam.

August 28, 1883. England. "I was just coming out of my observatory when, on the E.N.E. point of the horizon beneath the Pleiades, I saw a bright light. My first thought was that the moon was rising, but an instant's reflection sufficed to remind me that she would not be up for the next two hours. As I watched the light becoming brighter and brighter, I saw that it threw a kind of radial illumination upward, the effect of which I have tried to reproduce in the accompanying rough little sketch."

the mail bag

The following excerpt is from a letter by Philip Keillor a Coastal Engineer at the Sea Grant Institute at the University of Wisconsin - Madison.

Your summer 1987 issue of the Mariners Weather Log had the usual, interesting marine weather review for the first three months of the year. However, there was a disappointing omission ... the Great Lakes.

The Great Lakes had their share of interesting, but unmentioned, weather and "monsters of the month." On February 8, 1987, Chicago had an unusually large storm surge of nearly three feet and suffered severe damage from storm waves and flooding along its lakefront. On March 9, Milwaukee and other communities along the west shore of Lake Michigan had near-record storm surges and storm waves that caused severe damage.

There is also no mention in your "North Atlantic Weather Log" of storms that formed in the continental U.S., moved through the Great Lakes region and out over the Atlantic.

I hope that future issues of the Mariners Weather Log include descriptions of storms that form and track across the Great Lakes, along with observations of winds and waves made by Great Lakes mariners and recorded by the NOAA data buoys on the lakes.

It has been our policy in the past to publish an annual summary on Great Lakes weather for the navigation season. This contains a review similar to what Mr. Keillor recommends. We have been dong this since the magazine was started in 1957. The article usually appears in our summer issue. This year we were expecting an article from the Great Lakes Marine Weather Enhancement Program at Cleveland. They have been delayed in getting it to us but it should appear in the near future. However, Mr. Keillor's points are well taken and hopefully with some assistance from the Cleveland center we can include more on the Great Lakes in our routine summaries. Suggestions such as these are always welcome. — Ed.

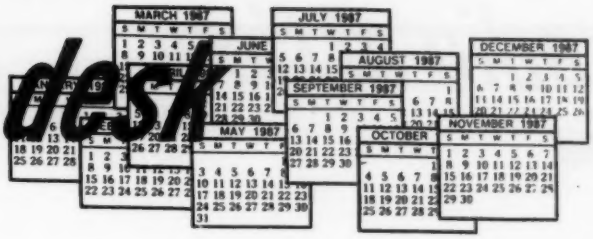
The following is an excerpt from a letter sent by frequent contributor Jerry Nickerson. He summarizes one of the topics discussed at the National Weather Association Conference.

On marine observations it was recommended that a Marine Automated Weather Station (MAWS) be developed to report each hour automatically over the INMARSAT communications system. The marine observation code must be modernized to keep in step with the decreased number of ships, fewer crew members and modern equipment. Marine observers should report in abbreviated format through the MAWS only when there is significant weather to report, otherwise the MARS reports senses weather hourly.

Freak waves have been defined and categorized into much more manageable forms. The Extreme Storm Wave (ESW) is believed in some way related to long term downburst events as described in the Winter 1985 edition of the Mariners Weather Log. When the USCG Icebreaker Polar Sea was struck by two groups of ESW (three sisters waves) we had excellent satellite infrared images of high, very cold clouds which could be associated with downbursts. This leads to the hope that ESW events may someday be forecast. Waves opposing currents are another category of freak waves, sometimes called a "Mallory " wave off South Africa, which could possibly be forecast. These waves also called "Cape Rollers" occur similarly in other currents like the Gulf Stream and the Kuroshio. Crossing wave trains produce a freak wave of sorts and are often noted in warnings on navigational charts. The Tsunami is a freak wave that is associated with earthquakes and has elaborate warning systems in place. Tectonic freak waves are associated with underwater landslides and cannot be warned against. There are other freak waves that occur in special areas under very specific conditions. These are the easiest to warn against, but require some expertise. However the possibility of saving ships, cargo and lives makes the continued study of freak waves imperative. Applications of simple principles by coastal forecasters could save many recreational boating accidents.

Jerry can now be reached at the following address:
Jerome W. Nickerson
4713 River Shore Rd.
Portsmouth, VA 23703-1517

the editor's desk



Changes

A couple of changes have been made in this issue, mainly due to circumstances beyond our control. The Worldwide Tropical Cyclone chart, which I had planned as a centerspread for each issue, will be dropped. We cannot obtain the data. The Joint Typhoon Warning Center is having their problems and information from India and Australia is years behind. Our only hope is an effort by the National Climatic Data Center who, through the WMO, is trying to push for a focal point for these important data. We will carry basin by basin summaries as they become available.

The extratropical track charts have a different look this issue. Because of a change in drafting procedures we are now numbering the tracks that are described in the text, where previously they were indicated by a heavier line. The numbers also show up in the text so that the track is easily matched to its description.

Soviet Help on Record Storm

In Response to a request we made to Dr. V.I. Smirnov, Director of World Data Center B1, we received this most cooperative and informative reply:

I am sending to you some comments by V.N. Skachkov, captain of the Valentine Serov on the storm of December 14-15, 1986.

The ***Valentine Serov*** proceeded from 55.2°N, 56°W to the fishing area with the coordinates 65.0°N, 54.0°W. Meteorological support was provided by "Murmansk-pogoda" surface weather facsimile charts (Northwood, Great Britain, and Halifax, Canada were also made use of). To leave the cyclone core (44°N, 53.4°W) portside and have the northeast wind right astern, the vessel held the 280° - 270° course. On December 14, 1986 a new cyclone, moving south southeastward, formed north of the first one. The air pressure decreased sharply. The wind speed was 28 - 30 m/s (54 - 58 kn) with 35 - 38 m/s (68 - 74 kn) gusts, with direction changing quickly from south to east. Confused swell was observed in all directions, the wave height amounted to 9 - 10 m (30 - 33 ft). The vessel suffered a bad roll with a 30° heel. To weather the storm, all the directions were tried but the roll did not subside.

On December 15, 1986 by 1800Z, near 60.3°N, 36.2°W, without any prospects for the weather improving, it was decided to break away from the grip of the converging cyclones at full speed, course 250°.

The ***Valentine Serov*** had been ready for sailing in the stormy sea. The crew were steadfast in the face of adversity. The ship was not damaged, neither were there any serious consequences for the crew, although some sailors suffered splitting headaches.

Herein please find enclosed an excerpt from the log of hydrometric observations made by the navigational staff of the vessel.

Manhattan May Be Scrap

The ***Manhattan***, first ship to make a commercial voyage through the Northwest Passage, is headed for the scrap yard. The owners have asked the Maritime Adiministration for permission to sell after she suffered severe hull damage when typhoon Thelma blew her onto the rocks in late July.

Log of the **Valentine Serov**, December 1986

Day	14	14	14	15	15	15	15
Time (GMT)	06	12	18	00	06	12	18
Long. (°N)	62.4	62.0	61.7	61.1	60.8	60.8	60.4
Lat. (°W)	30.0	31.3	33.5	36.3	37.5	37.6	39.0
Vsby (nmi)	10	2	2	2	2	2	2
Wind dir. (°)	210	100	060	040	320	330	270
Wind speed (kn)	27	31	60	60	60	58	56
Pressure (mb)	**973.5**	**967.4**	**928.2**	**920.2**	**940.3**	**955.0**	**964.3**
Sea per. (sec)	7	6	8	7	7	8	8
Sea ht. (ft)	10	7	16	16	16	20	20
Swell dir. (°)	—	220	130	100	090	020	340
Swell per. (sec)	—	10	14	14	14	16	16
Swell ht. (ft)	—	26	30	30	30	31	31

tips to the radio officer

--by Jullie L. Houston
National Weather Service
Silver Spring, Md.

Important Reminder Again!!

Some Ships transmitting OBS via USA CES INMARSAT are neglecting to disconnect the transmitter after sending their observations. This is causing a substantial cost to the National Weather Service (NWS). The NWS limit for an observation is not to exceed two minutes. For example, a ship failed to disconnect its sending equipment after completing the message leaving the transmitter open to 89.0 minutes costing a total of $404.95.

The NWS also reminds ships to use the correct format for Meteorological Surface OBS and Bathythermal OBS. For example:

(1) Bathys should start with **JJXX** and end with the **Call Sign**

(2) Met Surface OBS should begin with the **Ship's call sign** and end with **FIVE PERIODS.**

Interlacing Bathy and Ship Surfaces OBS format in one transmission results in loss of data within the system.

Update

The publication "Selected Worldwide Marine Weather Broadcast" is being reformatted and updated, please send any schedule changes to the following address:

National Weather Service
International Telecommunications
Section W/OS0151 Room 419
8060 13th Street
Silver Spring, MD 20910

INMARSAT Weather Reports

INMARSAT equipped ships may transmit weather messanges using the following procedures after the message is composed off-line:

1. Select U.S. Coast Earth Station Identification Code 01.

2.Select routine priority.

3. Select duplex telex channel.

4. Initiate the call. Upon receipt of GA+ (Go Ahead).

5. Select dial code for meteorological reports, 41, followed by the end of selection signal, +.

6. Upon receipt of our answerback, NWS OBS MHTS, transmit the ships call sign and the weather message only. Do not send any other preamble. Example:

GA+
41+
NWS OBS MHTS
WLXX 29003 99131 70808 41998 60909
10250 2021/ 40110 52003 71611 85264 22234 00261 20201 31100 40803 .....

The five periods indicate the end of the message.

7. Terminate the call with manual disconnect.

Mobile, AL Weather Facsimile Frequencies and Broadcast Schedules

Frequencies: **6852 KHz (24 Hours); 9157.5 KHz (1200Z-0000Z)**

Time	Broadcast Data	Time	Broadcast Data	Time	Broadcast Data
0250Z	00Z Surface Analysis	0920Z	Coastal Marine Forecast	1520Z	Unscheduled Forecasts
0300Z	Significant Weather Features	1100Z	Gulf Aviation Forecast	1800Z	Gulf Aviation Forecasts
0310Z	Offshore Marine Forecasts	1440Z	Radiofax Schedule (Monday)	2030Z	18Z Surface Analysis
0850Z	06Z Surface Analysis	1450Z	12Z Surface Analysis	2040Z	Sig. Weather Features
0900Z	Significant Weather Features	1500Z	Significant Weather Features	2050Z	18/36 Hour Sfc Prog.
0910Z	18/36 Hour Surface Prog.	1510Z	Offshore Marine Forecasts	2100Z	Coastal Waters Fcst
2110Z	Oceanographic Products — E.&W. Gulf Sea Sfc Temp Charts (Mon.); Atlantic Gulf Stream (Mon. & Fri.); East Gulf Ocean Features Chart (Mon.,Wed. & Fri.); West Gulf Ocean Features Chart (Tue. & Thur.); Ocean features Chart not available during Summer due isothermal conditions.				

hurricane alley

Tropical Cyclone Patsy
December 13-17, 1986

Sushil K. Sharma
and
Rajendra Prasad

Tropical cyclone Patsy developed about 120 miles northeast of Santo in Vanuatu on the 14th. It was a small cyclone with a short life history compared to many other tropical cyclones that have affected our region. During its lifespan as a tropical cyclone Patsy attained only storm intensity with maximum sustained winds estimated at 55 knots close to its center. It maintained storm intensity for about 48 hours, and thereafter decayed rapidly while still in the low latitudes, due to the influence of strong upper level shearing.

Minor damage to houses and root crops was reported from Santo. Nevertheless, banana plantations throughout Vanuatu seem to have suffered considerable damage due to strong winds and heavy rain.

A study of the wind field reinforces the opinion that Patsy was a very small tropical cyclone. As it did not pass directly over any weather reporting station it is difficult to assess its true intensity. None of the stations in the close proximity of Patsy reported sustained winds of over 30 knots, at any stage, although between 0600 and 1800 on the 16th, while the cyclone was still about 160 miles away, both, Koumac (northwestern part of New Caledonia) and Noumea reported winds up to 45 knots.

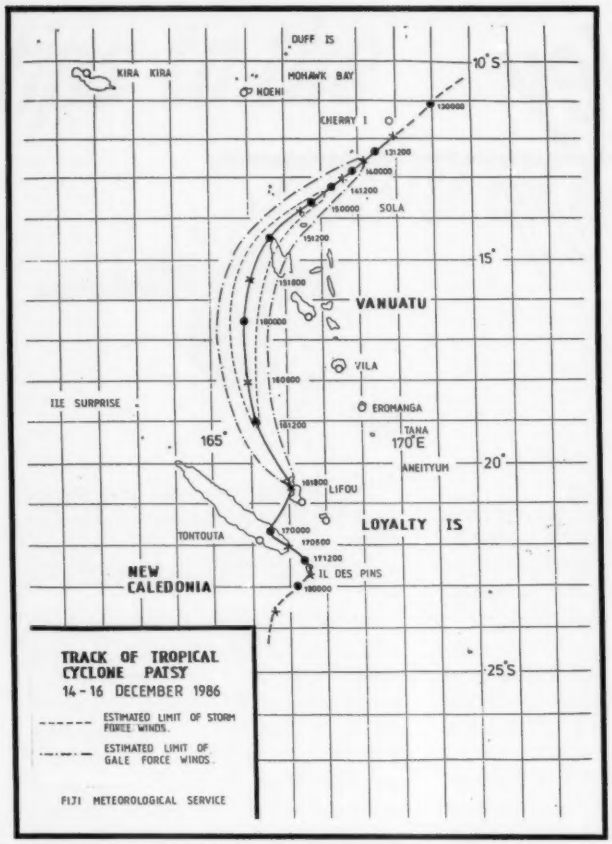
Similarly, a ship reported a southeasterly wind of 45 knots 1200 near Iles Des Pins. Patsy was centered far to the north at this stage and other intermediate stations like Lifou, which was much nearer to Patsy, reported winds between 15 and 30 knots only.

A very broad cyclonic circulation with a strong pressure gradient, due to a slow moving ridge to the south, seems to have been responsible for the rather wide area of gale force winds in the southern quadrant. It seems most likely that in the absence of any other cause, the northwest-southeast oriented mountain range in New Caledonia may have been responsible for the gales experienced in the southern half of the island, as evidenced by the wind reports from Koumac and Noumea.

The following table gives the maximum sustained wind, the maximum gust, and the lowest pressure as reported by some stations in Vanuatu during the passage of Patsy.

Tropical Cyclone Patsy

Station	Date/Time (GMT)	Minimum Pressure (mb)	Maximum Sustained Wind (kn)	Maximum Gust (kn)
Solo	150600	983.1	16	28
Pekoa AP	151200	987.8	22	41
Lamap	151500	993.1	30	40
Bauerfield	160400	995.3	20	41
Tanna	161700	998.0	23	36
Aneityum	161700	999.4	18	38



TROPICAL CYCLONE WINI
March 1-7 , 1987

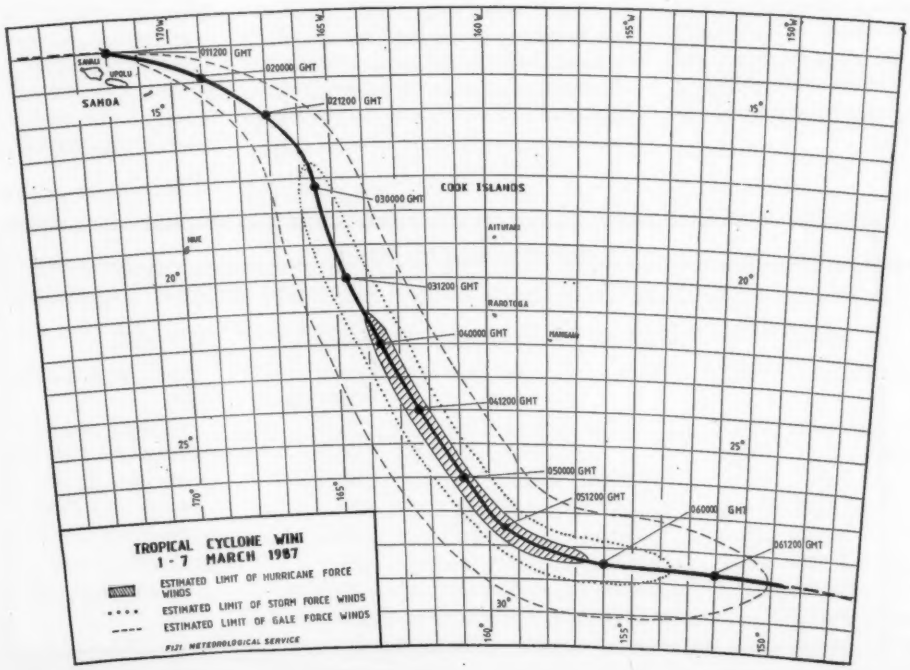
SHUSSHIL K. SHARMA
and
SATYA KISHORE

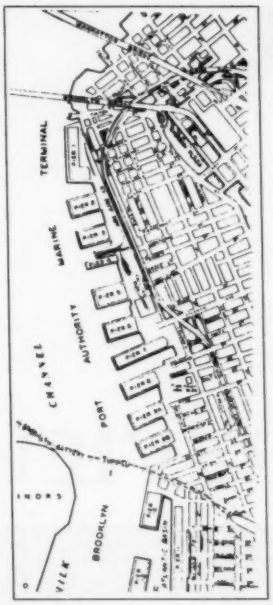
Tropical cyclone Wini had a fairly short life history. It developed just north of Samoa and moved southeastwards, passing just west of Palmerston Island, and in its final stages curved more to the east as it moved south of 25°S into higher latitudes.

Wini reached peak intensity with maximum sustained winds estimated at 7 knots close to its centre early on the 4th of March. It maintained hurricane intensity for about 48 hours.

Wini did not pass close to any inhabited island at its intense stage and therefore did not cause any loss of life or much damage to property. However, it did generate heavy swell over the Cook Islands. Palmerston reported heavy swell breaking about 200 feet inland, when Wini was centered northwest of this atoll.

There seems to have been little wind damage attributed directly to tropical cyclone Wini, though Palmerston reported maximum sustained winds of 30 knots as the cyclone passed to the west of this atoll. However, strong westerly winds generated swells which affected a number of island groups in the region, both before and after the passage of Wini. Some islands in the Northern and Southern Cooks reported extensive damage by high seas and heavy swells as Wini passed to the west of these islands.





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MARINE WEATHER REVIEW

April 1987 — A stubborn Icelandic Low (fig 1) refused to let summer have its way; but that's what spring is all about. This climatic feature was fed by a bevy of storms from Canada and the southwestern North Atlantic. The result was a -12 to -13 mb anomaly over Greenland. However, its influence was dampened somewhat, across the northern shipping lanes, by the northwestward extension of the normally placid Azores High. This led to a +10 mb anomaly over the Grand Banks and higher than normal pressure over a good portion of the northern seas. These two dynamic pressure features did make for an area of tight gradients from Labrador to Iceland, however, and this is where gales were most likely. This gradient also appears in the steering level at 700 mb. In addition large troughs were centered along the East Coast of the U.S. and between Greenland and northwest Africa; these influenced storm movements throughout the month.

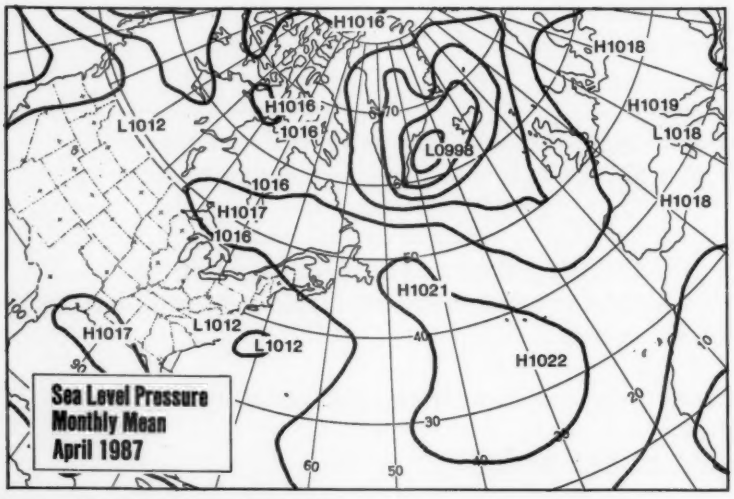

Figure 1.—The Icelandic Low hung in there..

On this date — April 16, 1851— the famous lighthouse storm raged near Boston Harbor. Whole gales and gigantic waves destroyed Minot Light with its two keepers inside. The storm resulted in great shipping losses and coastal erosion.

Extratropical Cyclones — Despite the larger than normal Azores High, storms were plentiful on both sides of the Atlantic. While they lacked the severity of winter storms, they still caused some rough times for mariner and coastal residents alike.

At the beginning of the month rains over New England and the Maritime Provinces resulted in widespread flooding. In Maine water lapped at rooftops as canoes floated across flooded streets on the 2d. Rivers swollen by rain and melting snow ripped out bridges and swept houses downstream. Damage was worst along the Kennebec River where NWS hydrologist Jerry

The Weather Logs combined with the cyclone tracks, U.S. Ocean Buoy Climatological Data, gale and wave tables and mean pressure patterns provide a definitive report on the primary storms that affect the North Atlantic and North Pacific Oceans. The Monster of the Month is a title given to an extratropical storm that may have been particularly hazardous to shipping. All storms are dangerous! Unless otherwise stated, winds are sustained and time is GMT. The numbers that appear in the text refer to the storm track in the track charts.

North Atlantic Weather Log

April, May and June

French called the flood a "500-yr event". In Winslow the Ft. Halifax stockade, built in 1754, was swept away by the Kennebec (fig 2). The fort, which was the oldest standing wooden fortification in the U.S., was built by the British to defend the frontier against the French and Indians. Nearly 2 thousand New Brunswickers fled their homes along the St. Johns River as ice jams sent water cascading through the streets and into basements. The largest river in the Maritimes was at its worst in Perth-Andover reaching 16 ft above normal and felling the 950-ft long railway bridge.

Although flooding and snow melt are common in April, winter would not go peacefully. On the 28th and 29th a late season storm off the coast of Massachusetts blanketed portions of New England with up to 1 1/2 ft of snow. At Worcester, MA it fell at the rate of 2 in per hour.

❶ This potent storm, which did not appear on the track chart because it was stationary, formed on the 2d. It developed along a cold front that hung in a general north-south position from Scotland to the eastern

Maine Historic Preservation Commission

Figure 2.—The Ft. Halifax Blockhouse survived the ravages of weather, and early French and Indian attacks for more than 230 yr. However in April it was swept away by a wild Kennebec River.

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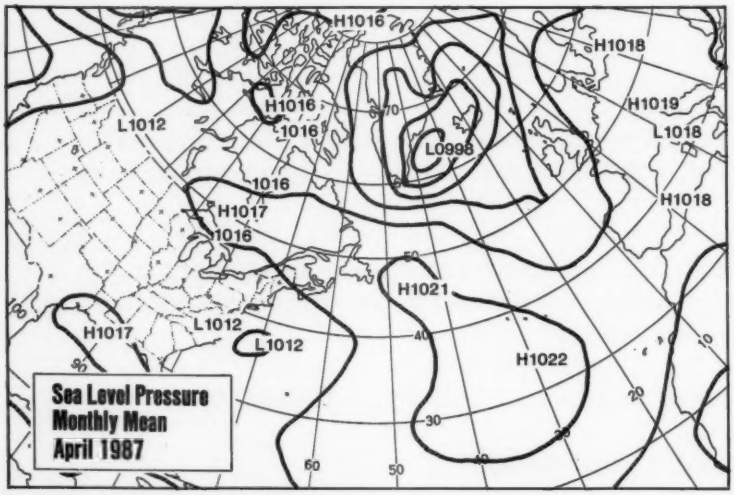

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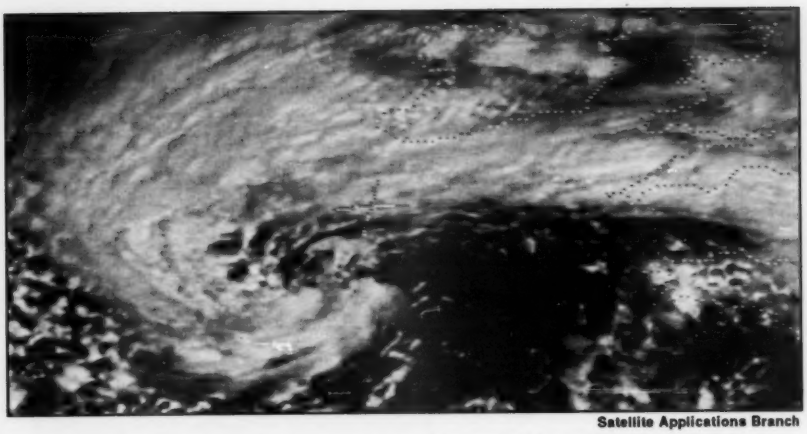
Satellite Applications Branch

Figure 3.— Potent stationary Low just southwest of the English Channel at 1130 on the 3d.

Mediterranean. It was spotted just west of the Bay of Biscay. Gales were reported mainly in the western semicircle. An unidentified vessel (48°N, 24°W) encoun-

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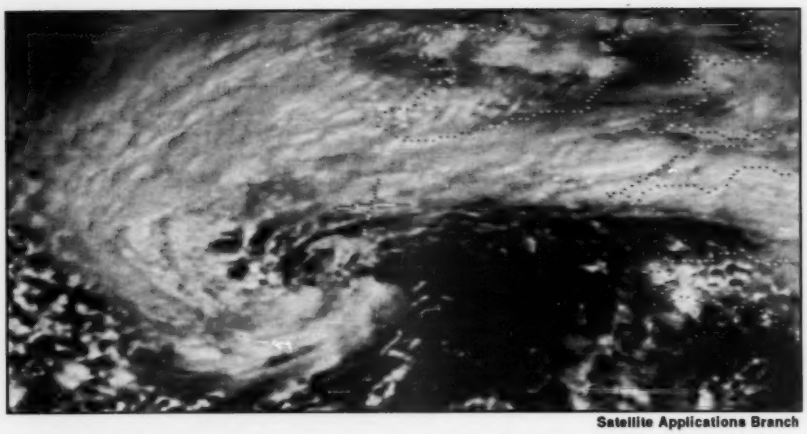

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❷ Although one of these storms came to life on the 3d, over eastern Tennessee, and the other on the 9th, south of Bermuda, they had a date to meet on the 11th southwest of Iceland. This meeting was helped along by a huge 1032-mb High, which was dominating weather over most of the southeastern North Atlantic and forcing storms in the west to move northeastward. The Tennessee Low took its sweet time getting organized. It wasn't until the 10th that it looked like anything. By this time its 988-mb center was over Newfoundland and it trailed a stationary front all the way into the Caribbean. It was along this front that the Bermuda system developed. On the 12th ***OSV C***, at 0000 reported 40-kn south southwesterlies in 20-ft seas to the south of a complex storm center. A few hours later the merger was complete and a 972-mb storm was haunting the northern shipping lanes, as it entered the Denmark St. Gales were common and seas were running at 8 to 12 ft. At 0000 on the 15th the ***Disarfell*** (63°N, 19°W) hit 52-kn west southwesterlies. By this time the 966-mb storm was centered near Jan Mayen. The associated front was pushing across the British Isles. The circulation covered a large area from the Denmark St to the North Sea. It finally began to weaken on the 16th.

❸ This contributor to the Icelandic Low actually started near Reindeer Lake, west of Hudson Bay on the 15th. However, until the 20th, it was nothing to write home about. At 1200 the ***Nosira Sharon***, some 700 mi south of the 972-mb center, encountered 45-kn west southwesterlies in 36-ft seas; this occurred behind the associated cold front, but indicated the potency of the system. The storm moved across Greenland on the 21st as it headed northward. That seemed to help weaken the system, which was good news for mariners. However another storm was waiting in the wings.

❹ This storm originated near the Custer National Forest, in South Dakota. After trekking across Hudson Bay on the 20th, it moved into the Labrador Sea on the 21st.

Satellite Applications Branch

Figure 4.—Storm is caught south of Kap Farvel at about 1800 on the 22d.

By the following day its central pressure was 976 mb just south of Kap Farvel (fig 4). The ***Cape Roger***, at 1200 on the 22d radioed a key report, which showed the intensity of this system. About 300 mi southwest of the center she encountered 51-kn northwesterlies in 23-ft seas. A 1028-mb High to the south was helping to tighten the pressure gradients over the northern shipping lanes. Scattered reports of gale force winds came in during the 23d, as the storm made its way up the east coast of Greenland. Although it maintained its identity over the next several days, winds remained below gale force according to ship reports. However, a trailing storm, created some gales in the Denmark St, on the 26th, as testified to by the ***Nikolay Kononov***, which hit 35-kn southwesterlies in 16-ft seas near 61°N, 30°W at 1200.

Tropical Cyclones — April remains the only month, since 1871, in which a tropical cyclone has not developed. In addition there are no reports back to 1492 that a tropical storm or hurricane ever formed during April — maybe next year.

Casualties — On the 11th the motor vessel ***Clipper Courage*** was caught in heavy weather while sailing from San

Wide World

Figure 5.— Crewmen stand on the hull of the overturned Hatian freighter prior to Coast Guard rescue on the 17th.

Pedro, Ivory Coast to Galway in Ireland. The ship listed 25° to starboard due to a shift of the timber cargo. At the time a Low was over the North Sea and another southwest of Iceland. Three days later in the Caribbean the bulk carrier ***Everhope*** collided with the ***Wildcat*** in heavy weather. At the time the eastern part of the Sea was under the influence of a weak Low. The following day (15th) the yacht ***Celestial***, the Caribbean to Greece, sustained heavy weather damage and lost a starboard anchor. On the Great Lakes, off Buffington Harbor, an 80-ft crane barge being pulled by the tug ***Walter R.***, began taking on water in rough seas. When the situation worsened the two men on the barge were ordered to abandon the vessel. But the tug couldn't find them in the icy waters. The barge sunk and the bodies were found in the engine room. About mid month the Haitian freighter Aristeo capsized (fig 5) when its cargo shifted, about 35 mi off the coast of Florida. One crewman was killed and three others missing.

May 1987 — Usually a tranquil month over the North Atlantic, this year May was even more so. However don't tell that to the passengers and crew that were sailing the Queen Elizabeth 2 from New York to Southampton. They managed to encounter the worst storm of the month. For the most part the Bermuda-Azores High, which is usually building toward a summer peak, pushed north of its normal position to dominate the northeastern North Atlantic (fig 6). The result was a + 11-mb anomaly centered near 50°N, 20°W. This blocking situation shunted the storms that did develop into the Denmark and Davis Straits. This was reflected at 700 mb where a deep trough was established in the Labrador Sea, with a ridge north and south of Iceland.

On this date — May 7, 1840 — A powerful tornado wrecked many boats at the Natchez Landing in Mississippi. It then plowed through the city on the bluff. The force of the storm caused houses to burst open; 317 people died. This tornado was considered the most deadly and destructive in early American history.

Extratropical Cyclones — The month opened with a storm that had moved down from Hudson Bay merging with a system from the Delaware Bay. These Lows began in April but atmospheric systems show little respect for the boundaries of time. The system did create some rough conditions over the Grand Banks and Labrador Sea for a few days but was forced northward by a large 1036-mb High. This set the tone for the month. Most of the storm activity was confined to the western North Atlantic and very few of these generated gales. On the 21st and 22d a Low moved across the Great Lakes region. It triggered thunderstorms in which the ***Charles M. Beeghly*** encountered 99-kn winds on Lake Michigan, it was reported.

"The storm was completely unexpected. It was the worst weather the ship had been through in about 15 years".

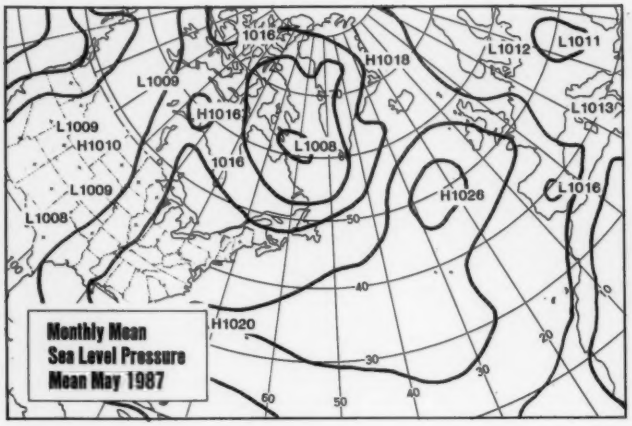


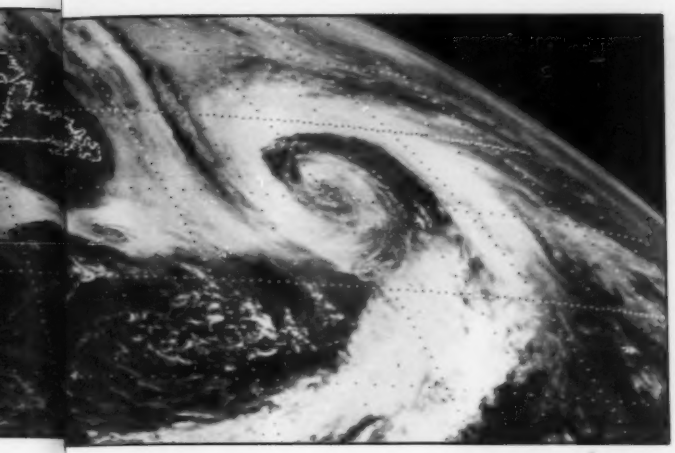
Figure 6.—The Azores-Bermuda High dominates the climatological patterns.

Figure 7.—The storm that rocked the QE II at 1331 on the 27th.

❶ Monster of the Month — This Low had its origins along a stationary front that stretched eastward to 30°W from the Chesapeake Bay, for several days prior to the 25th. It was one of several atmospheric waves. One of these had already generated gales. On the 23d the CGON reported 45-kn southwesterlies near 44 °N, 64° W, and the VDCG hit a 47-kn blow near 46°N, 53°W. This however was just a prelude of things to come. On the 25th the system that was to become the monster, showed up near 40°N, 50°W, as one of several centers vying for attention. By the following day it was evident that the monster was beginning to take control. On the 26th the ***Smolensk*** (42°N, 46°W) encountered 45-kn northeasterlies, at 0000, and 6 hr later the ***Weimar*** and the ***Witsupply II*** hit 45- and 52-kn winds respectively; the ***Weimar*** also reported 20-ft swells. This storm continued to intensify and by the 27th the central pressure was down to 980 mb, as it headed toward the northeast. It was on this date that the ***Queen Elizabeth II (QE 2)*** ran into this storm. Now compared to most winter storms it wouldn't rank very high. However its impact on shipping during this transition period was enough to qualify the storm for the subjective monster rating. At 0000 (fig 7) the ***QE 2*** encountered 50-kn winds from the north northwest, while sailing 120 mi east of the center. More important was the sea and swell report. Seas were estimated at 33 ft with a period of 3 sec. This indicates seas must have been breaking; swells were also estimated at 33 ft. At 0600 on the 27th the ***QE 2*** (44.6°N, 41.6°W) reported a 981.8-mb pressure while battling 50-kn winds and more normal 20-ft seas, about 60 mi southwest of the storm center. The rough conditions rocked the passenger liner throwing passengers and food across the dining room and forcing Capt. Lawrence Portet to sit strapped to this chair on the bridge. An officer who requested anonymity said "The storm was completely unexpected. It was the worst weather the ship had been through in about 15 years." Many of the 1800 passengers were treated for severe seasickness and dozens reportedly suffered broken bones and other injuries when they were thrown around in the heaving ship. "Most of the crew said it was the worst listing they had ever experienced. Some thought it would never come up again," one of the crew said. After it was over the passengers were given a newsletter explaining that winds had reached force 10 with seas as high as 37.5 ft. It was a small but potent storm. At 1200 on the 27th, the ***QE 2's*** assessment of conditions were verified by the ***Enterprise*** (44°N, 44°W), which reported 60-kn north northeasterlies; seas however were running 16 ft. In fact of the many vessels that reported during this storm maximum significant wave heights reported reached 25 ft. The ***QE 2*** may have run into some isolated freak waves. Gale force winds were reported by the ***Pavlik Larichkine, Canmar Ambassador, Kolskiy Zaliv*** and the ***Bridgewater*** among others. Even though the storm began to fill on the 28th there was no lack of gale reports, in the 40- to 45-kn range. At 1200 the ***Nuernberg Express*** (46°N, 39°W) reported 25-ft seas and 30-ft swells. The system continued to create some problems throughout the 29th , but faded as the month came to a close.

Tropical Cyclones — Since 1871, 14 tropical cyclones have developed in May. There were none this year. However a tropical depression did develop east of the Bahamas on the 25th. The last May tropical storm came to life in 1981 while the last hurricane was Alma in 1970.

Casualties — The ***Dart Atlantica*** suffered contact damage at Le Harve on the 4th while the vessel was maneuvering to enter the locks and landed heavily against the quay as a consequence of strong, gusty



Satellite Applications Branch

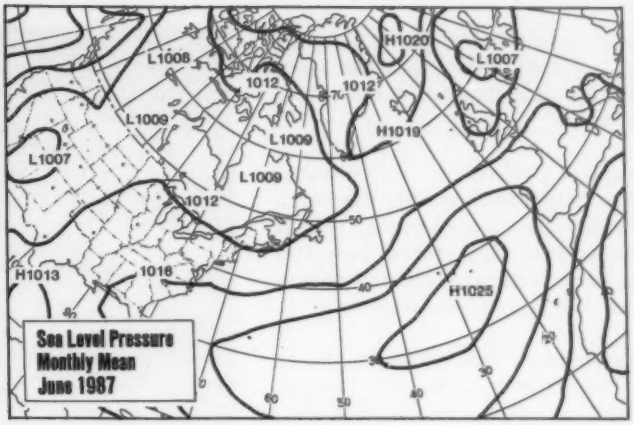


Figure 8.—June featured a weaker-than-normal Bermuda High.

winds. The ***Queen Elizabeth 2*** ran into problems as detailed in the text. In the predawn darkness and dense fog in the English Channel, on the 30th, the 67,239-ton supertanker ***Skyron*** plowed into the Polish cargo ship ***Hel***. The Liberian-registered supertanker, carrying 137,000 tons of crude oil, burst into flames, which were quelled before reaching the hold, averting a potential major environmental disaster. The incident took place 25 mi east of the Kent County coast.

June 1987 — This is the season for the Azores-Bermuda High to take control with the Icelandic Low weakening and moving over the Labrador Sea. Over the western North Atlantic the High was weaker than normal as several storms intruded east and south of the Grand Banks (fig 8). Storms also accounted for a -6 mb anomaly over the Baltic Sea region. However, a +8 mb anomaly resulted from a lack of action in the Denmark St. The 700-mb flow was zonal west of about 50°W where it turned east northeastward as a result of troughing and then became zonal again east of 30°W.

On this date — June 6, 1816 — The temperature reached 92°F at Salem, MA during an early heat wave. It then dropped 49°F in 24 hr to commence the famous "year without a summe.r"

Extratropical Cyclones — Activity was plentiful over the northern shipping lanes although storms, on the whole, were not particularly intense. On the 6th and 7th a freak storm swept southwest France and northern Spain. Rescue officers reported 9 people killed and 15 missing. Some 13 thousand homes lost electricity as winds up to 59 kn uprooted utility poles and trees. This was associated with frontal activity from the first described storm of the month.

❶ This storm popped up on the 3d near 44°N, 41°W. It move northeastward toward the British Isles as it intensified. At 1200 on the 5th a VSBG vessel, near 48°N, 17°W hit 42-kn west northwesterlies in 20-ft swells. The 990-mb storm was nearing Ireland at this time. The ***Iolair***, at 0600 on the 6th, reported a 40-kn blow in the North Sea, about 100 mi east of the storm center, which had crossed through Scotland. At 1800 several vessels in the North Sea hit 40-kn winds in seas of 10 ft. The ***Kildare*** near the western entrance to the English Channel encountered 23-ft swells. By the 7th the storm was absorbed by another system over Norway.

❷ On the 15th a Low came to life over the Grand Banks, out of a complex system that was centered over Labrador. The new Low quickly took command and by 1200 on the 16th its central pressure was down to 984 mb. A few gales were being reported to the south and east of the northward moving center. At 1800 on the 17th the ***Iceport***, about 120 mi. northwest of the now eastward moving center, encountered 44-kn northeasterlies. The system had started to fill by this time, and although it was tracked until the 21st the real action was to the east.

❸ A weak short-lived system that formed west of Ireland on the 18th moved across England the following day and fizzled over France, created a few bad moments. On the 18th at 1200 the ***Lafjord*** off the southern tip of Norway hit 54-kn northwesterlies in 15-ft seas. In the southern part of the North Sea the PFKS reported 40-kn winds from the north northwest. As quickly as it had sprung up the storm fizzled. Its circulation was briefly enhanced by a ridge of high pressure, which had managed to wedge itself in between this storm and the previous one.

❹ This storm was first detected on the 25th about 600 mi south of Kap Farvel. By 1200 on the 26th it was a nicely organized storm with a 985-mb central pressure. Twelve hr later the pressure was down to 976 mb. Vessels such as the ***Fuscus*** and ***Pierre Radisson*** had been reporting 40-kn winds on the 25th and 26th. At 0600 on the 27th the ***Koeln Express*** (57°N, 36°W) hit 46-kn northeasterlies in 23-ft swells. The 984-mb storm was heading northeastward toward Iceland (fig 9). The ***Scol Enterprise*** continued in rough weather into the 28th. At 0000 she reported 45-kn southerlies in 23-ft swells. By midday on the 28th there was evidence that the system was beginning to fill. Central pressure was estimated at 988 mb and gale

reports were scattered. By the 29th pressure had risen to 992 mb and, as the month came to a close, the storm was weakening further.

Tropical Cyclones — June is usually acknowledged as the opening of the North Atlantic tropical cyclone season. There is usually one every 2 yr, on the average. Last year a tropical storm and a hurricane developed. This year, June came up empty.

Casualties — The ***Sam Houston*** was surveyed in Newport News for damage allegedly sustained to her port side accommodation ladder in heavy weather encountered between the 26th and 30th enroute from Port Kelang, Malaysia.

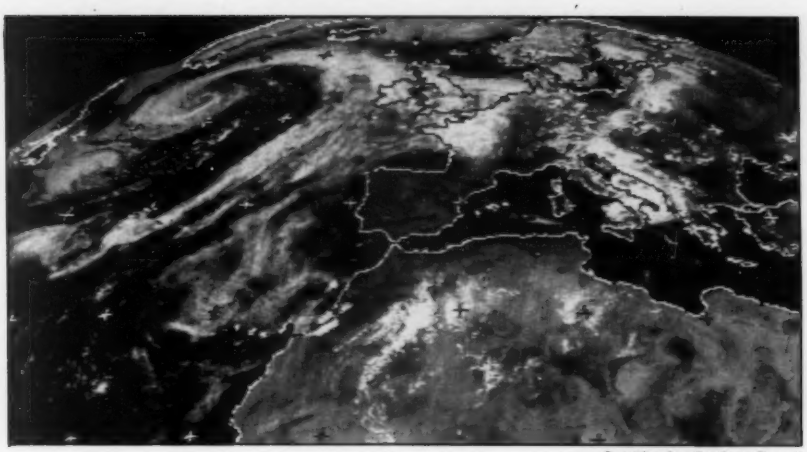


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Figure 9.—Storm is seen in top left with a well- defined frontal system at 1200 on the 27th.

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Marine Weather Review (cont'd)

North Pacific Weather Log
April, May and June

April 1987 — The climatic chart (fig 1) for this month looks like a cross between October and July. The Aleutian Low stretched over the Bering Sea and Gulf of Alaska, where its 998-mb center resulted in a -12 mb anomaly. The subtropical high to the south was 3 mb stronger than normal, with less of a westward push than normal. Simply, this means the storm activity was above normal from Japan through the southern Bering Sea into the Gulf of Alaska. One look at the storm tracks shows this to be the case; particularly in the Gulf of Alaska. The mean 700-mb steering level indicated a more or less zonal flow between 150°E and 150°W. Near the U.S. Pacific Coast the flow swings toward the northeast while in the Orient it was out of the west northwest.

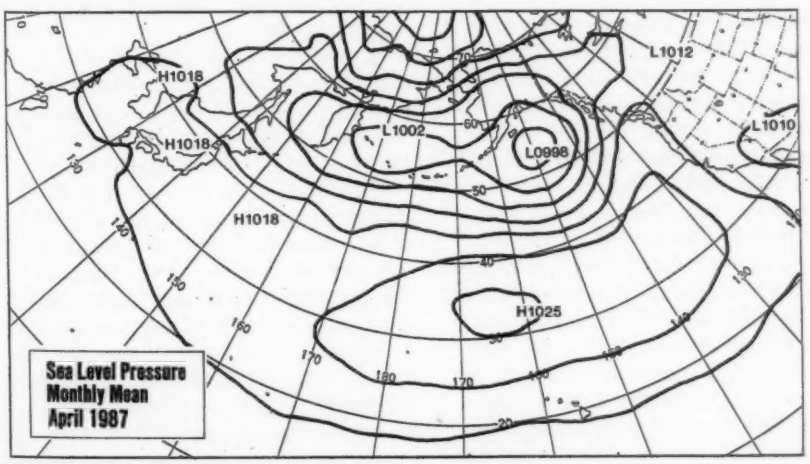

Figure 1.—The Aleutian Low spreads out.

On this date —April 8, 1967—Typhoon Violet generating 105-kn winds moved across Luzon. In its wake Violet left four people dead. She had attained peak strength several days before when pressure dipped to 929 mb and winds reached 120 kn.

Extratropical Cyclones —The Gulf of Alaska was besieged by storms throughout the month. Many were short-lived, but intense, while several made the trek from Japan and China. Late in the month, from about the 20th through the 22d a storm moved over Korea and caused havoc. Some 18 people were killed and 14 injured in South Korea in storm-related accidents. The storm also forced some 12 thousand vessels to take shelter at ports throughout the country.

❶ This storm developed on the 1st, near Shanghai, as a wave along a stationary

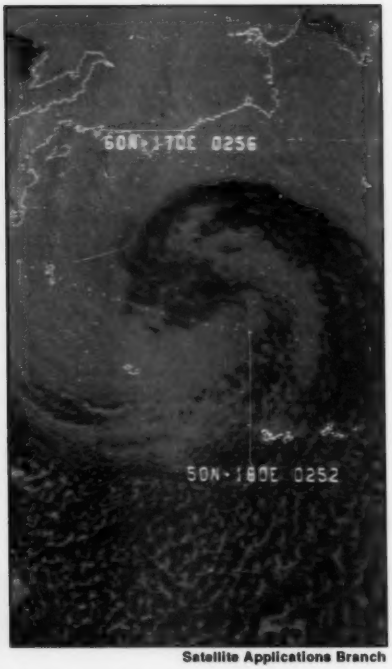

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Figure 2.—A potent system at 0246 on the 2d.

front. Moving through the East China Sea and the Sea of Japan during the next few days it developed slowly. It wasn't until the 4th, south of the Aleutians, that central pressure dipped below 1000 mb. Then, however, things began to pick up. By 0000 on the 5th pressure fell to 980 mb and a ship south of the center, but ahead of the cold front, ran into a 40-kn south southwest wind. Six hr later a ELCN vessel hit 52-kn winds with a 983-mb pressure readings in a violent rain shower. By 1200 on the 5th a number of vessels were reporting rough weather. The ***Oriental Phoenix*** and ***Silver Star*** were among those reporting 35-to 40-kn winds in 10-to 25-ft seas. Some 240 mi southwest of the center the ***Kowloon Voyager*** measured 59-kn westerlies in 28-ft seas with a slope of about 1/12—pretty steep. On the 6th the 972-mb center, paralleling the Alaska Peninsula, moved into the Gulf of Alaska. At 1800, on the 7th, the ***Antoni Carnusmewski*** (43°N, 137°E) was belted by 50-kn southwesterlies in 13-ft swells. The following day the Low moved northward onto the Alaska mainland and appeared to be weakening. However, it turned a counterclockwise loop and reintensified, on the 9th, once it returned to the Gulf. By the 10th, at 0000, central pressure was down to 958 mb and the circulation covered the entire Gulf of Alaska. The ***Exxon New Orleans***, north of the center, ran into 50-kn east northeasterlies in 16-ft seas with a 980- mb pressure. She was also encountering continuous heavy drizzle which was restricting visibility to about 2 mi. The ***Manhattan*** provided valuable information on the extent of this storm when she reported 40-kn winds in the 16-ft swells some 600 mi. south of the center. The system began to weaken on the 11th and was finally pushed ashore for good on the 12th.

❷ This semi-stationary system did not appear as a storm track on the monthly chart but is indicated by No. 2. It was a short-lived but wicked storm that generated storm force winds over the northern shipping routes on the 2d. It developed early on the 1st near 50°N, 170°E. By 1200 the central pressure was estimated at 946 mb and the system was moving northeastward. The ***Star Hongkong***, in the storm's southwest quadrant, about 550 mi from the center, encountered 45-kn west southwesterlies with a 989-mb pressure. The closest station to the center was Shemya in the Aleutians, which reported a 950-mb pressure. Twelve hours later, at 0000 on the 2d, central pressure was estimated at below 930 mb (fig 2). A raft of vessels were hit by storm force winds. The ***Neptune Canopus*** (51°N, 165°E) hit 63-kn westerlies in 33-ft swells; her pressure was 976 mb and she was battling squalls with visibility at 200 yd. The ***Dairyu Maru*** reported a 939-mb pressure while battling 56-kn winds about 60 mi south of the storm's center. The ***Princes Highway*** battled 40-ft swells in 52-kn winds near 52°N, 179°W. Gales extended about 800 mi to the south and southwest. The blow continued throughout the day, but there was little movement. At 1200 on the 2d pressure was still at 934 mb and the circulation covered most of the western North Pacific. Many ships were reporting temperatures below freezing. For example, the ***Valentina*** in 52-kn winds, with a 27°-F temperature had a wind chill of about - 12°F. The winds, waves and temperatures were right for potential superstructure icing problems. The storm remained potent into the 3d and 35-to 40-kn winds were common in swells of 15 to 35 ft in the shipping lanes. The

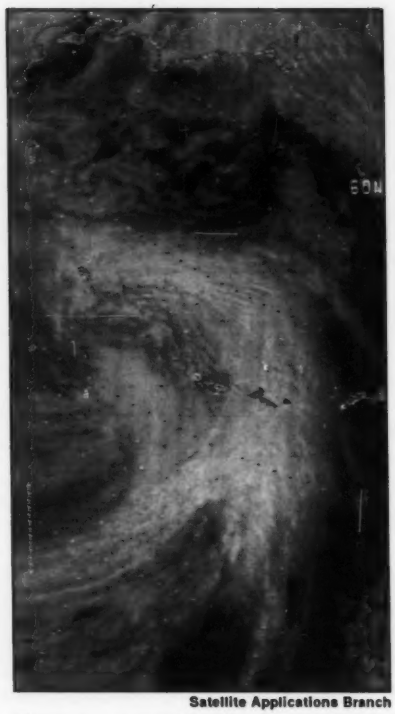

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Figure 3.—A merging of Lows on the 28th at 0124.

Neptune Canopus was still battling 33-ft swells with winds running about 53 kn, at 0000. The nearly stationary system began to fill during the day.

❸ A complex situation developed on the 14th that was responsible for several days of bad weather in and around the Gulf of Alaska. A 968-mb Low had moved into the northwestern Gulf from the Bering Sea with another center over Alaska. A secondary system developed along its trailing stationary front far to the southwest. The following day the Gulf of Alaska storm weakened somewhat and the secondary system moved rapidly northeastward. By early on the 16th, this secondary Low had incorporated itself into the large circulation of the weakening system and its pressure fell to 960 mb. The infusion was enough to trigger gales to the south and southwest of the center. The ***Bay Bridge*** encountered 40-kn winds in 15-ft swells, near 50°N, 150°W. Along the coast, McInnes Is, BC was ripped by 40-kn southerlies. During the day, however, the storm filled rapidly.

❹ These two storms formed toward the

latter part of the month and eventually merged into one significant system. The Japanese storm developed just east of Kyushu on the 22d and headed northeastward. A few days later its Chinese counterpart came to life north of Shanghai and headed east northeastward. The Japanese system moved along the Kurils and across the Kamchatka Peninsula before turning eastward on the 26th. At this time the China storm was over Tokyo and not much of a system. The Japan Low was at 986 mb and generating some gale force winds along the Kurils and to the southeast of its center. The following day, between the two, now-converging, systems and a large 1036-mb High centered over mid ocean, a tight gradient was developing from Honshu to the Alaska Peninsula. Winds of 30 to 35 kn were common. The two systems merged on the 28th and the fireworks began (fig 3). An unidentified vessel (50°N, 177°E) was belted by 61-kn southwesterlies while the ***Eastern Royal*** ran into 48-kn westerlies some 480 mi southwest of the 968-mb center. Other valuable reports were radioed in by the ***Japan Oak, Frisia,*** JNUS and the ***Fort Dufferin.*** Late on the 28th the ***Perennial Ace*** and the ***Kansai Pioneer*** both hit winds of more than 50 kn near 54°N, 175°W. Storm winds kept blowing as the system moved through the southern Bering Sea and into the Gulf of Alaska on the 29th. On the 30th it began to fill.

Tropical Cyclones — Tropical storm Percy developed near Nakuoro Atoll in the Caroline Is on the 3d. After a drought of 5 yr this was the second year in a row to see an April tropical cyclone. Percy intensified slowly and it was not until the 10th, just north of Woleai Atoll, that it reached tropical storm strength. The storm was on a west northwesterly course. It peaked out on the 11th when maximum winds climbed to 40 kn, as it turned northwestward through the southern Marianas. By the 12th Percy was back to depression strength, but hung on for 3 more days.

Casualties— On the 16th the bulk carrier ***Azalea Star*** dragged her anchor in heavy weather and grounded at Prince Rupert. This was about the time that storm No. 3 was generating gales at McInnes Is, BC. On the 21st the mv ***Jung Yung No. 15,*** partially loaded, grounded in Busan's south harbor, in strong winds and heavy seas, while attempting to find shelter. The same day the ***Almandarch,*** Suez for Japan, grounded off Busan.

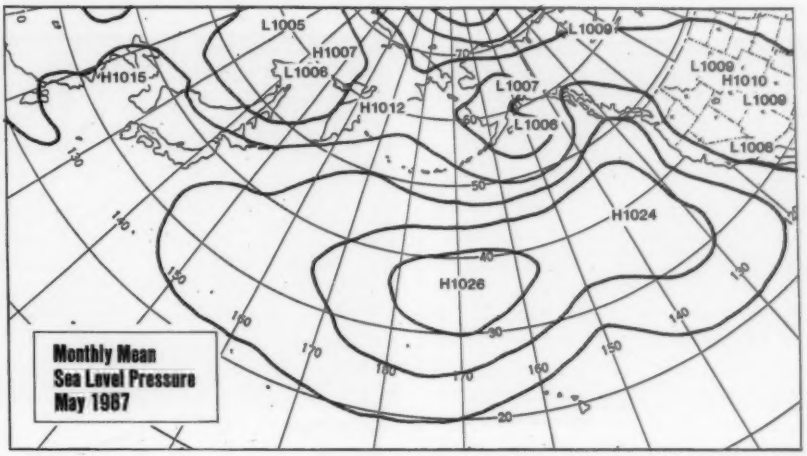

Figure 4.— A near-normal look for May.

May 1987 — The mean pressure chart (fig 4) showed nothing outstanding for the month. However there were some subtle changes from the normal that explained the storm patterns. The Aleutian Low was forced into the Gulf of Alaska, which had more than its normal flurry of spring activity. This resulted in a - 6 mb anomaly centered in the Gulf. The subtropical high which is usually building at this time of year was dominant, but its center was well west of its normal position. This resulted in a + 6 mb anomaly near 40°N, 170°W and positive anomalies pushing northwestward toward the Kamchatka Peninsula. The 700 mb pattern was mainly zonal, from west to east, except for some cyclonic curvature in the Gulf of Alaska.

On this date — May 18, 1980 — Mount Saint Helens in Washington State erupted, spewing ash and smoke 63,000 ft into the air. Heavy ash covered the ground near the Volcano while small particles were carried to the Atlantic Coast.

Extratropical Cyclones — While there were few big storms this month a number of small, short-lived, but gale- producing lows haunted the northern shipping lanes. The Gulf of Alaska saw more than its fair share of activity and an oddball Low even created a few headaches north of the Hawaiian Is. From the 20th through the 23d heavy rains over southern China caused extensive flooding, which resulted in the forced evacuation of more than 350 thousand people. In Guangdong Province 92 people drowned or were killed by lightning while 400 were injured.

❶ This Low was first picked up on the 2d over southwestern Honshu. It was joined the following day by another center from the Northern part of the Island to form a powerful system over the southern Kuril Is. By 1200 on the 4th central pressure dropped to 965 mb. Reports of 45- to 47-kn winds were received by the ***Bo un No. 5,*** UUVN and DMJ at 0000, south and southeast of the center. At 1200 the ***Sovietskaia Sibir*** (51°N, 156°E) encountered 47-kn south southwesterlies and a 986-mb pressure. The storm continued to intensify. This was testified to by the ***Mys Danly.*** She hit 58-kn southerlies near 57°N, 154°E. Her pressure was 966.7 mb and swell was running 16 ft. At 0600 the ***Pavel Postychev*** (58°N, 158°E) ran into 56-kn southerlies and reported a 979-mb pressure. Six hr later the ***Vassilii Poutintsev*** confirmed this intensity when she reported 54-kn southerlies. The system lost it on the 5th, after crossing the Sea of Okhotsk.

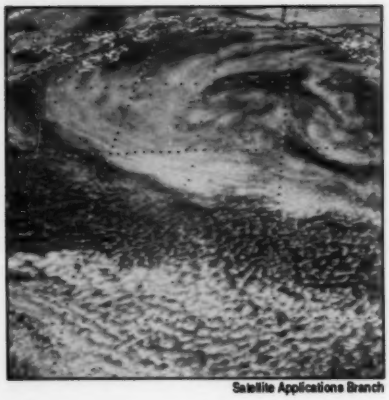

Figure 5.— The Gulf of Alaska is storm-covered at 2015 on the 30th.

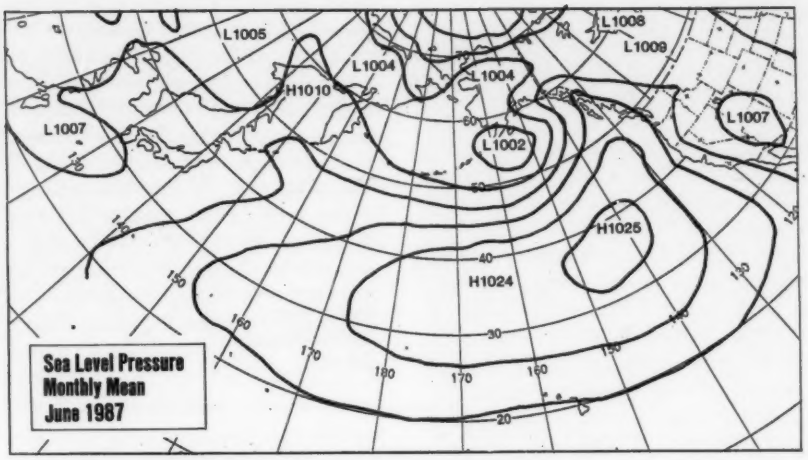

Figure 6.— A stubborn Aleutian Low

❷ At 1200 on the 8th a report came in from the ***Melville*** near 33°N, 146°W. She reported 48-kn north northwest winds in 18-ft swells. At first glance this might look like an erroneous report, since there were no tropical storms in the area. However, a small but potent wave had formed along a stationary front and the ***Melville*** was right in the middle of it. Twelve hr later she was still near the center although the reported 92-kn wind seems way out of proportion; it may have been a transmission error although the rest of the report seems okay. Nearby, the ***President Johnson*** reported 72-kn northerlies, which also seems high and didn't match the rest of her report. Nevertheless this system was affecting the shipping at particularly low latitudes. Gales were reported into the 11th; at 0000 the ***Nedlloyd Van Diemen*** ran into 35-kn north northeasterlies in 16-ft swells about 300 mi northwest of the center. In the Hawaiian Is winds were in the 15- to 20- kn range. The system weakened significantly on the 12th.

❸ Out of a flurry of late month Lows came one that was particularly intense. It began as a small disturbance on the 25th near 40°N, 160°E. Moving east northeastward it intensified slowly. On the 27th, after crossing the dateline, pressure dropped to 987 mb. However it wasn't until the 29th that the 978-mb storm began to be noticed. Actually at 1800 on the 28th the ***Chelsea*** provided advance warning when she ran into 50-kn northerlies near 46°N, 150°W; she also reported 23-ft seas with a slope about 1/8 — very steep. At 0000 on the 29th the ***Poler Ace*** (50°N, 136°W) was blasted by 62-kn south southeasterlies and the ***Razoolnoye*** (56°N, 149°E) encountered 45-kn south southeasterlies. Later in the day several vessels reported winds in the 45-to 48- kn range in 18- to 20- ft swells about 300 mi east southeast of the center, which was swinging northward. At 1200 on the 30th the central pressure was down to 976 mb (fig 5). The system was not only dominating the entire Gulf of Alaska, but influencing weather to 35°N, east of 160°W. At 0000 on the 30th, the CGCC (53°N, 131°W) was nailed by 55-kn southeast winds, while the ***Daishu Maru*** was pounded by 48-kn north northwesterlies near 54°N, 155°W. At 1500, in 20-ft swells, the ***Microba*** reported 42-kn westerlies near 44°N, 137°W. Six hr later the ***Aries*** hit 54-kn westerlies about 300 mi southeast of the center. On the 31st the storm began to weaken and split into two centers, one over land and the other in the Gulf.

Tropical Cyclones — Since 1966 some 23 tropical cyclones have developed in the west and 12 tropical cyclones have come to life in the east, during May. This year however was quiet.

Casualties — On the 26th in Singapore the ***Euroexpress*** drifted loose during bad weather. She collided with three other vessels at the Eastern Working Anchorage. These vessels were the ***Huatai***, ***Hae Woo No. 3*** and the ***Inzhener Yamburenko***.

June 1987 — At a time when the subtropical high takes the spotlight, it was upstaged by the Aleutian Low, which was centered over the Gulf of Alaska (fig 6). This resulted in large negative anomalies along the northern shipping lanes reaching -11 mb in the Gulf. This is not to say that the subtropical high was dormant. In fact it was displaced west of its normal position resulting in a +5 mb anomaly between 170°W and the dateline. The steering patterns at 700 mb were oriented generally from the west southwest to the east northeast, turning northeastward into the Gulf of Alaska east of 150°W.

On this date — June 5, 1945 — Typhoon Viper struck Admiral Halsey's Third Fleet southeast of Okinawa, causing severe damage to cruisers and heavy carriers.

Extratropical Cyclones — As reflected by the resurgence of the Aleutian Low, the hotbed of activity was the Gulf of Alaska. Several storms also moved along the Aleutian Is causing some rough weather over the northern shipping lanes.

❶ This system was first detected on the 10th in the Gulf of Alaska. However its real origins can be traced back to a system that moved through the Bering Sea from the 7th through the 9th. On the 9th along a frontal system associated with the Bering Sea storm, spawned an atmospheric wave off the Alaska Peninsula. At 0600 the ***Surveyor*** (59°N, 147°W) encountered

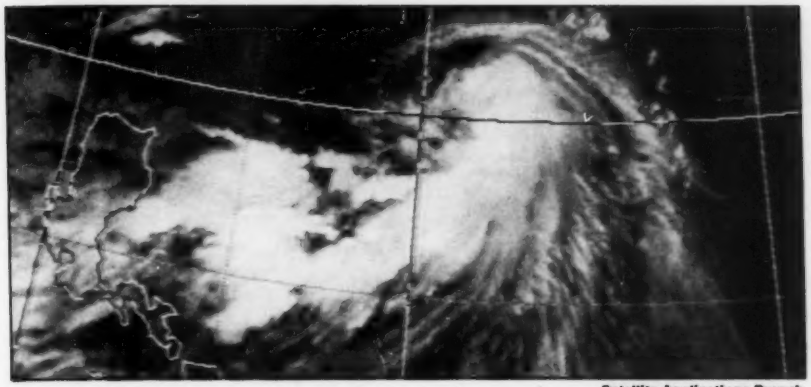

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Figure 7.—Typhoon Sperry at 2100 on the 29th.

43-kn east southeasterlies. Early the next day it was estimating winds at 64 kn near the storm's 986-mb center. By 0000 on the 11th the system was dominating the entire Gulf of Alaska. Central pressure dropped to 972 mb by 1200 as the storm tracked slowly northeastward. As far away as 42°N, 152°W the ***Hidaka Maru*** was belted with 41-kn winds. In general however ship's wind reports were in the 20-to 30-kn range with swells of 5 to 15 ft. The system fizzled on the 14th as it moved ashore.

❷ While the previous storm was waning over Alaska two other systems were merging in the Aleutians to form another potent Gulf of Alaska storm. Both of these system came to life on the 11th — one off the Kamchatka Peninsula and the other well east of Tokyo. Neither was anything to write home about until they combined on the 15th. This merger took place near Unimak Is. By 0000 on the 16th the 990-mb Low was heading for the Gulf. The ***Tatekawa Maru*** (54°N, 152°W) provided a clue to the storm's intensity, at 0600, when she encountered 43-kn south southeasterlies in 12-ft seas. At 1800 the ***Katori Maru*** (50°N, 140°W) hit 41-kn winds in 13-ft swells. Six hr later, at 0000 on the 17th, the ***President Grant***, some 480 mi east of the center, encountered 45-kn south southeasterlies in 26-ft seas. The ***Fairweather***, at 0600, near 57°N, 157°W, hit 40-kn northeasterlies; she recorded a 986.9-mb pressure. At 1200 the central pressure was estimated at 982 mb. The storm turned northward about this time and 24-hr later was over land.

❸ A short-lived but potent storm popped up southwest of Tokyo on the 20th. The ***Suoh Maru*** (31°N, 134°E) hit 50-kn westerlies while the BKHW (36°N,. 144°E) reported a 60-kn blow; both reported at 0000 on the 20th. During the day several vessels reported in with 48-kn to 52-kn winds in 12-to 16-ft swells. The following day with central pressure down to 984 mb wind reports in the 44- to 50-kn range were common. Swells were running 13 to 25 ft. Reports were received by such vessels as the ***Shin Beishu Maru, Tomiwaka Maru No. 8, Century Leader No. 3*** and the ***Parfentii Gretchanyi***. These reports continued throughout the day and into the 22d. However on the 22d the northeastward moving storm began to fill.

❹ While the previous storm was weakening, another system to the east, which had formed at the same time, was just starting to get it together. On the 22d at 1200 it crossed 160°W near 45°N with a 993-mb pressure center. Just 12 hr later pressure had dropped to 971 mb. The ***Ming Promotion***, just south of the center at 0000 on the 23d, ran into 47-kn northwesterlies and recorded a 978-mb pressure. About 200 mi east of the center the ***Sammi Fortune*** hit 41-kn southeasterlies. Late in the day the ***Chevron California*** (48°N, 151°W) was ripped by 55-kn west southwesterlies in 25-ft seas with a very steep slope of about 1/8. At 0000 on the 24th she was still reporting 44-kn winds in 21-ft seas. By this time the Low was starting to fill. At 1200 the central pressure had risen to 988 mb as the center slowed and began to stall. At 1800, near 58°N, 137°W, the ***John N. Cobb*** ran into 48-kn winds as the storm still had a little kick left.

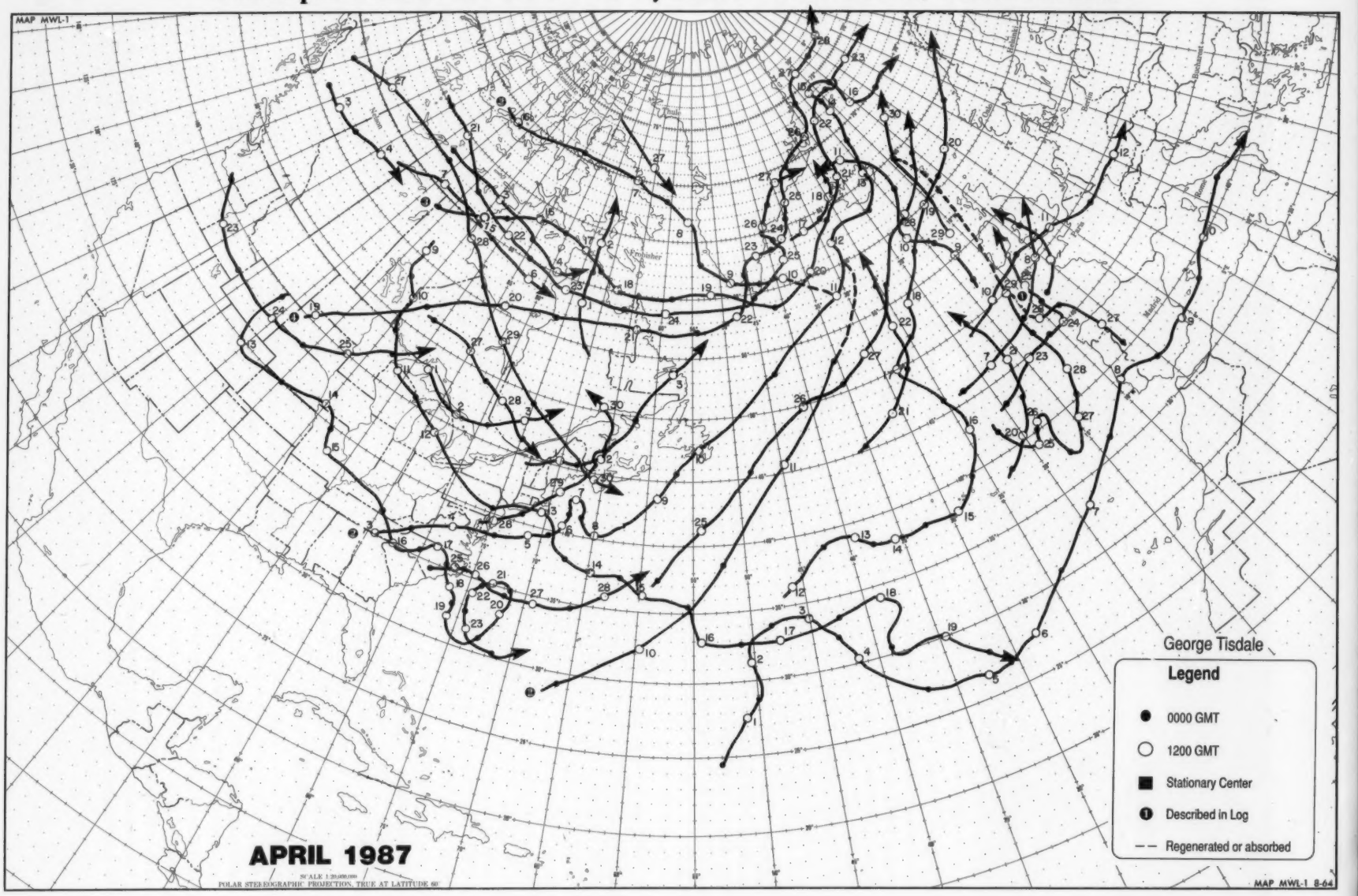
Tropical Cyclones — In the western North Pacific tropical storm Ruth and typhoon Sperry came to life while tropical storm Adrian flared up briefly in the east.

On the 8th Adrian was spotted about 150 mi south of Puerto Angel. Winds of 40 kn were estimated near its center with gales extending out only 35 mi. The small storm moved slowly westward. By the 9th it had dropped back to tropical depression strength, as it neared the 100°W meridian. In the west, Ruth came to life on the 17th, in the South China Sea, just south of Pratas Is. The depression moved westward. The following day it turned toward the northwest and attained minimal tropical storm intensity of 35 kn. Moving west northwestward Ruth entered southern China on the 19th. The storm generated torrential rains over Guangdong Province, which swamped some 440 sq mi of farmland, mostly rice paddies. It was responsible for 7 deaths and 86 injuries, while an estimated 45 thousand homes were destroyed.

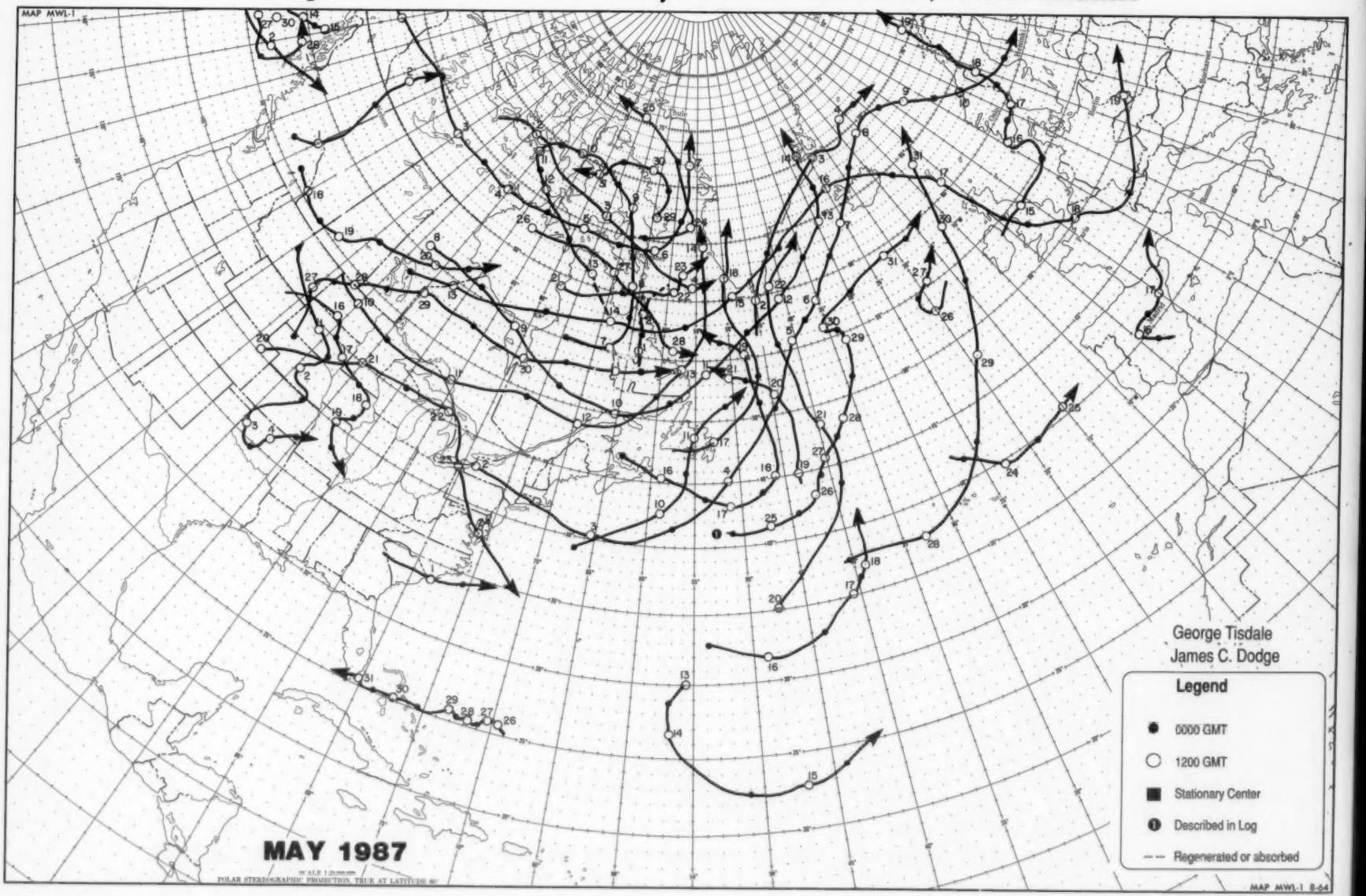
On the 24th, typhoon Sperry was detected about 150 mi north of Puluwate Atoll in the Caroline Is. Moving west northwestward it remained a tropical depression until the 27th. After turning toward the north northwest Sperry reached typhoon strength early on the 28th. A short time later it crossed the 15th parallel near 135°E. Sperry attained peak intensity late on the 28th and early the next day, when maximum sustained winds reached 75 kn (fig 7). It remained a typhoon until the 30th. At 0000 on the 30th the ***Banshu Maru*** , just south of the center, encountered 50-kn southerlies in 23-ft swells. Sperry began to recurve toward the north northwest during the day. On the lst it began to turn extratropical and eventually became a Low along a stationary from southeast of Tokyo.

Casualties — There were no reports in the Pacific, but some problems were reported off Sri Lanka in the Indian Ocean. On the 23d the ***Dayspring*** ran into trouble in heavy seas as did the ***Star Carrier***. Both crews abandoned their bulk carriers. The ***Oceanic*** picked up 33 crewmen from the ***Dayspring*** while a passing gas carrier rescued the 24 crew members from the ***Star Carrier***.

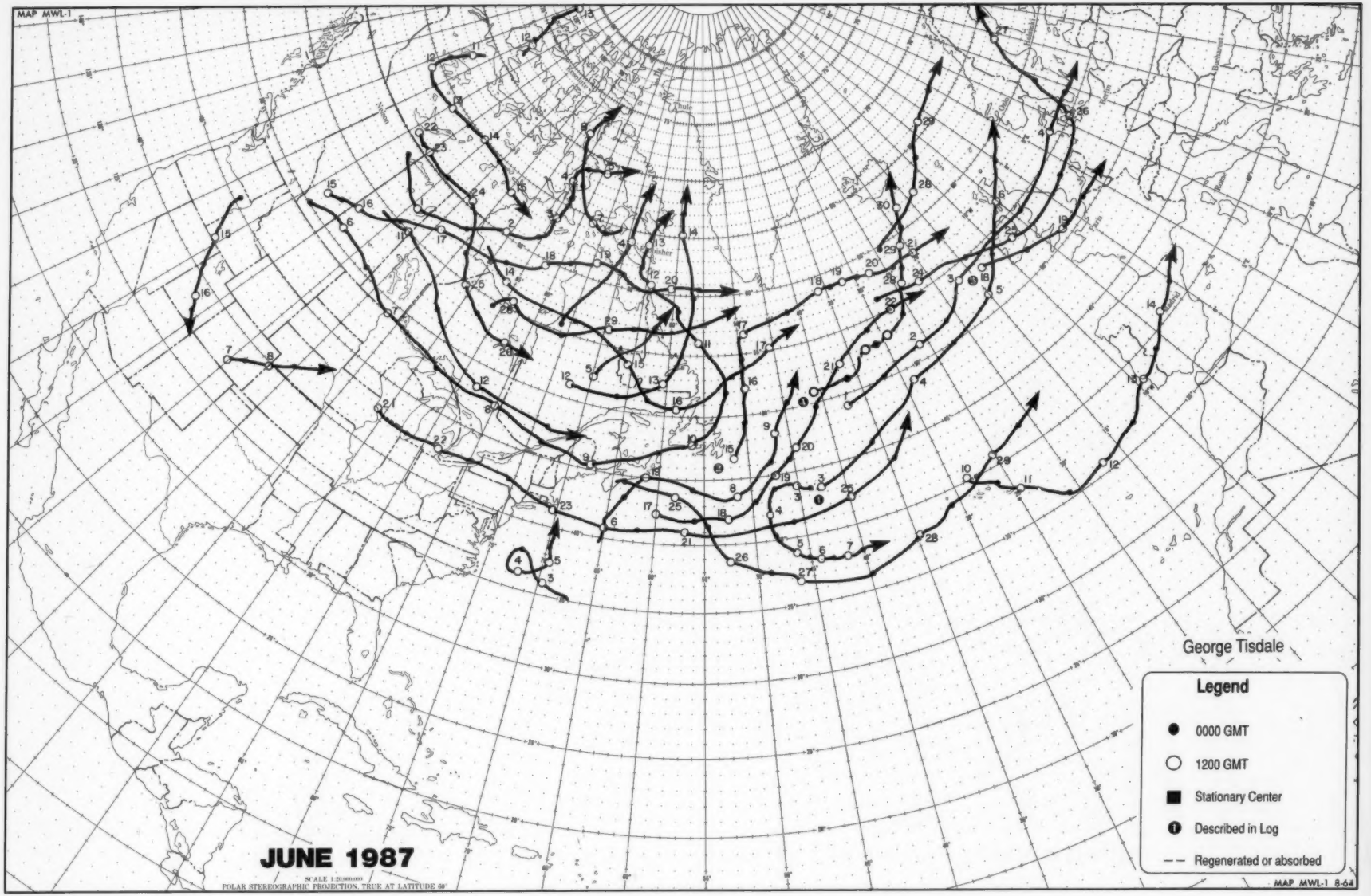
Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic



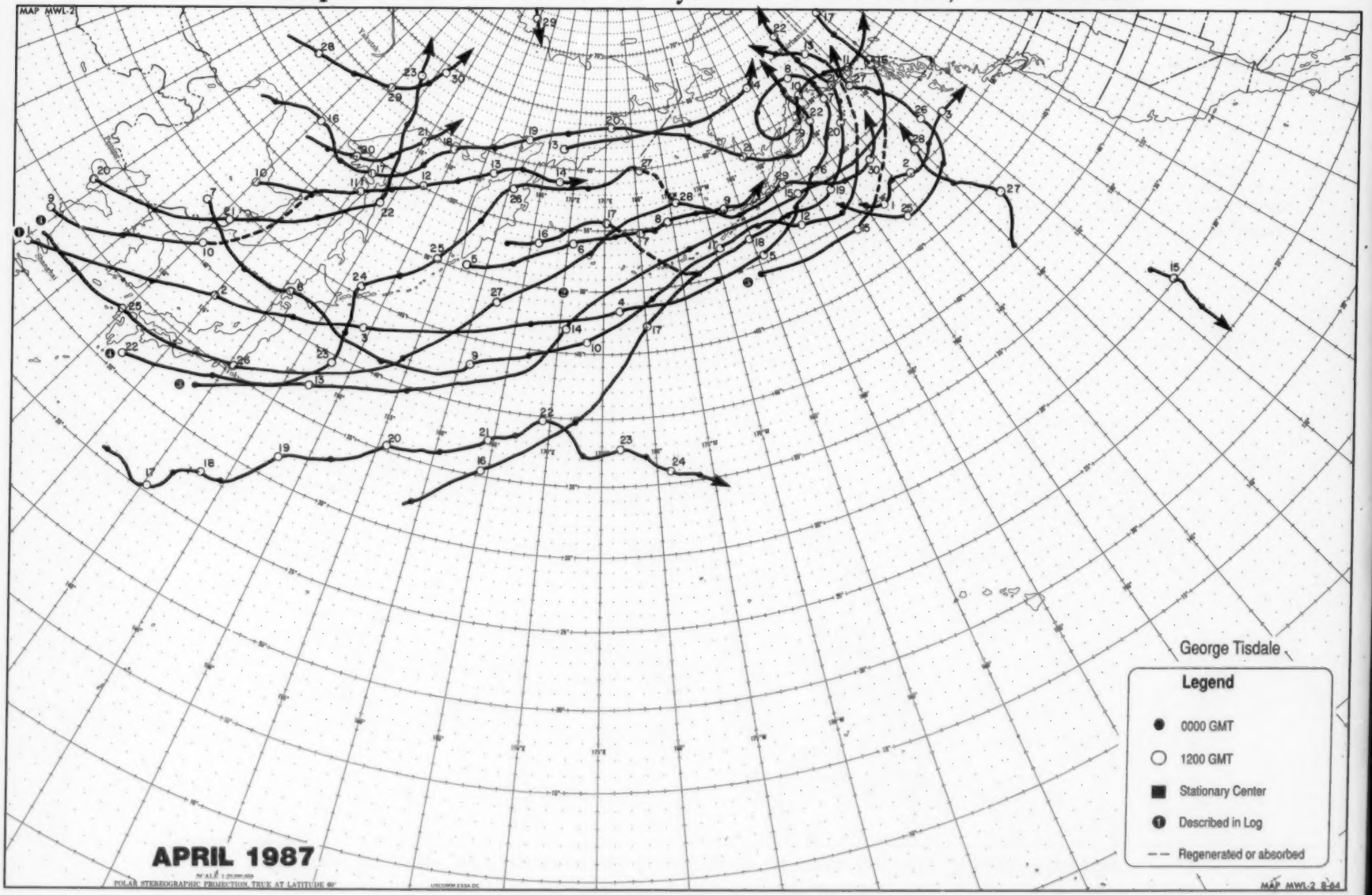
Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic



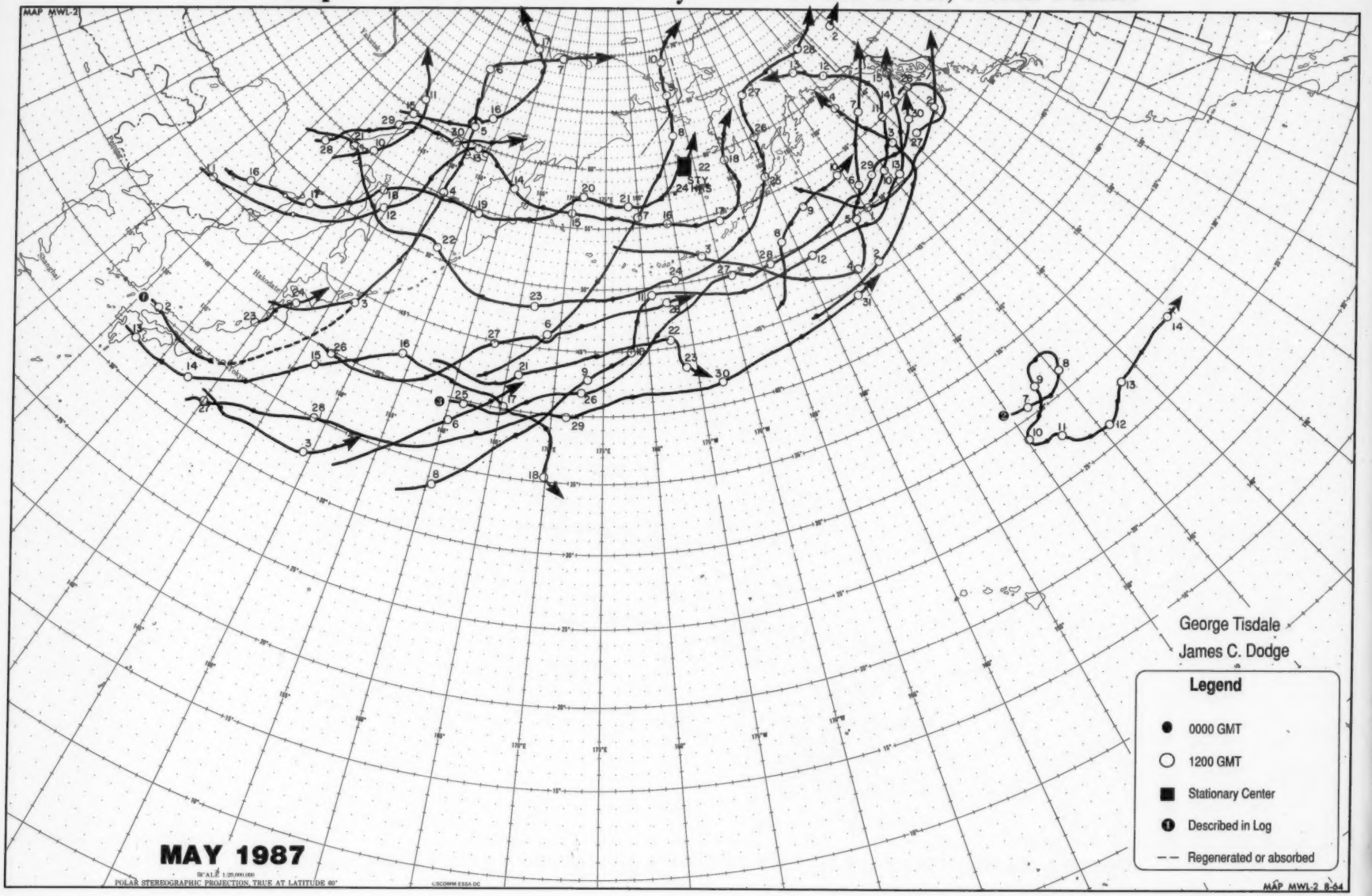
Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic



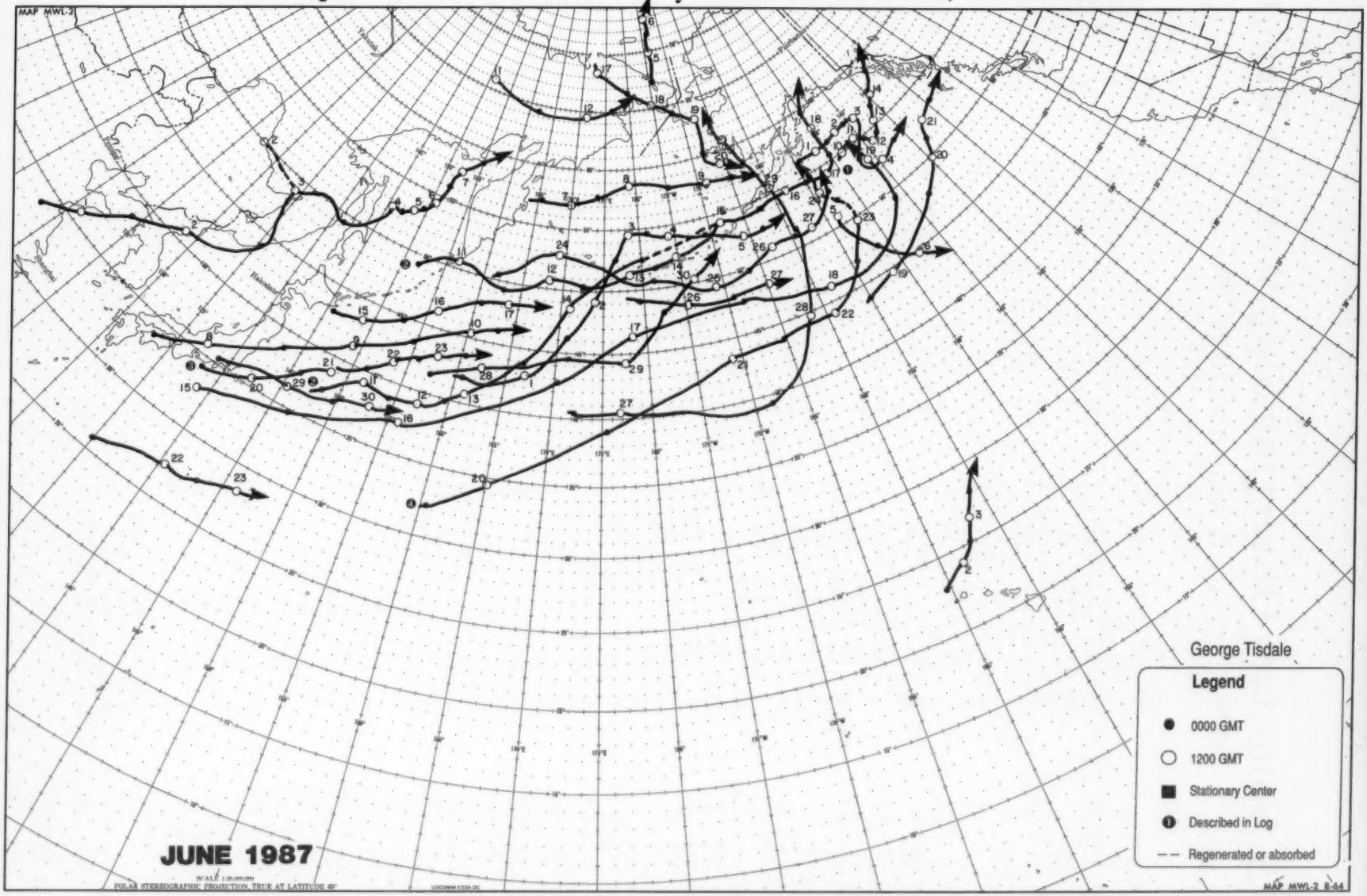
Principal Tracks of Centers of Cyclones at Sea Level, North Pacific



Principal Tracks of Centers of Cyclones at Sea Level, North Pacific



Principal Tracks of Centers of Cyclones at Sea Level, North Pacific



U.S. Voluntary Observing Ship Weather Reports

April, May and June 1987

SHIP NAME	VIA RADIO	VIA MAIL
1ST LT ALEX BONNYMAN	26	118
2ND LT. JOHN P. BOBO	52	15
ACE ACCORD	82	86
ACT 10	49	105
ACT 111	89	
ACT 5	19	
ACT 6	22	
ACT 7	139	
ACT 9	66	
ACT I	52	
ACT II	49	197
ACT IV	23	
ADABELLE LYKES	77	128
ADDIRIYAH	20	
ADM. W.M.CALLAGHAN		11
ADMIRALTY BAY	3	69
ADONIS	1	89
ADRIAN MAERSK	16	74
AIDA	47	96
AL AHMADIAH	28	
ALASKA MARU	56	
ALASKA RAINBOW	30	159
ALBERT MAERSK	14	78
ALBULA		29
ALEMANIA EXPRESS	66	
ALLEMAGNA EXPRESS	46	44
ALLIGATOR FORTUNE	72	
ALLIGATOR GLORY	36	110
ALLIGATOR HOPE	61	163
ALMUDENA	12	47
ALTAMONTE	44	119
ALVA MAERSK	25	50
AMBASSADOR BRIDGE	180	142
AMELIA TOPIC	5	161
AMERICA EXPRESS	36	
AMERICA SUN	15	103
AMERICAN APOLLO	2	4
AMERICAN ARGO	20	112
AMERICAN ASTRONAUT	5	24
AMERICAN CONDOR	19	47
AMERICAN CORMORANT	58	
AMERICAN EAGLE	49	24
AMERICAN ENTENTE	75	212
AMERICAN ENVOY	25	242
AMERICAN FALCON	45	137
AMERICAN HARRISON	43	116
AMERICAN HAWAII	5	51
AMERICAN HERITAGE		13
AMERICAN MARINER		40
AMERICAN MARKETER		44
AMERICAN MERCHANT	79	188
AMERICAN MICHIGAN	24	
AMERICAN PIONEER	35	31
AMERICAN PURITAN	1	
AMERICAN REPUBLIC		34
AMERICAN RESOLUTE	15	98
AMERICAN TITAN AK 1008	1	
AMERICAN TROJAN	44	28
AMERICAN VEGA	11	80
AMERICAN VETERAN	6	76
AMERICANA	21	77
AMOCO BALTIMORE	12	19
AMOCO YORKTOWN	1	
ANDERS MAERSK	11	
ANITA	21	
ANONA	10	
ANTHONY RAINBOW	59	
AQUA CITY	126	134
AQUA GARDEN	42	132
AQUARIUS	50	152
ARCHON	26	88
ARCO ALASKA	27	37
ARCO ANCHORAGE	14	44
ARCO CALIFORNIA	7	59
ARCO FAIRBANKS	15	23
ARCO INDEPENDENCE		3
ARCO JUNEAU	30	36
ARCO PRUDHOE BAY	30	41
ARCO SAG RIVER	26	14
ARCO SPIRIT	27	39
ARCO TEXAS	24	29
ARCTIC TOKYO		106
ARGONAUT	26	93
ARILD MAERSK	28	65
ARMCO	86	112
ARNOLD MAERSK	19	54
ARTHUR M. ANDERSON	102	139
ASHLEY LYKES	7	36
ASIA WINDS	65	
ASIAN EXPRESS	40	113
ASIAN HIGHWAY	59	
ASIAN VENTURE	17	
ASPEN	13	58
ATIGUN PASS	77	226
ATLANTIC	55	88
ATLANTIC RAINBOW	23	103
ATLANTIC SAGA	70	
ATLANTIC SERVICE	15	
ATLANTIC SONG	20	
ATLANTIC SPIRIT	18	159
ATLANTIC STAR	80	
AURORA	8	66
AUSTANGER	6	23
AUSTRAL RAINBOW	34	
AUSTRALIA	1	
B.T. ALASKA	50	142
B.T. SAN DIEGO	68	94
BABB ULLAH	30	65
BABUYAN	1	
BACOL SANTOS	52	
BALTIMORE TRADER	31	115
BAR' ZAN	8	13
BARBER NARA	5	
BARBER PERSEUS	120	
BARBER TAMPA	30	
BARBER TEXAS	8	
BARBER TOBA	26	20
BARRYDALE	62	
BAY BRIDGE	37	
BCR KING	64	
BCR QUEEN	61	
BEAUTEOUS	7	
BENSON FORD		91
BERNINA	28	108
BHARATENDU	4	
BHAVABHUTI	7	1
BIBI	3	
BISLIG BAY	78	
BOGASARI LIMA	70	67
BORINQUEN	30	86
BRINTON LYKES	43	
BROOKLYN	10	23
BROOKLYN BRIDGE	23	18
BROOKS RANGE	24	45
BULK GARLAND	114	154
BUNGA KENANGA	1	
BUNGA KESIDANG	80	64
BUNGA MELAWIS	96	108
BURNS HARBOR		94
CALCITE II	70	71
CALIFORNIA RAINBOW	36	102
CALIFORNIA VENUS	29	
CANAL ACE		21
CAPE BORDA	1	5
CAPE HORN	51	56
CARIBE 1	48	70
CARLA A. HILLS		149
CAVARA	87	88
CELEBRATION	3	47
CENPAC 2	22	33
CGM LORRAINE	64	
CHARLES M. BEEGHLEY	14	27
CHARLOTTE LYKES	43	186
CHARLOTTE MAERSK	8	
CHASTINE MAERSK	48	91
CHELSEA	49	136
CHEMICAL PIONEER	15	83
CHERRY VALLEY	33	78
CHESAPEAKE TRADER	7	82
CHESNUT HILL	6	45
CHEVRON ANTWERP	57	116
CHEVRON BURNABY	74	251
CHEVRON CALIFORNIA	32	82
CHEVRON COLORADO	2	22
CHEVRON COPENHAGEN	36	112
CHEVRON EDIMBURGH	34	135
CHEVRON EQUATOR	22	174
CHEVRON FELUY	41	199
CHEVRON FRANKFURT	20	
CHEVRON LONDON		81
CHEVRON LOUISIANA	40	66
CHEVRON METEOR	7	80
CHEVRON MISSISSIPPI	80	119
CHEVRON NAGASAKI	10	177
CHEVRON OREGON	33	47
CHEVRON PACIFIC	14	127
CHEVRON STAR	23	81
CHEVRON SUN	12	155
CHEVRON WASHINGTON	22	101
CHIJIN	59	63
CHIKUMAGAWA MARU	15	
CHRISTIAN MAERSK	9	39
CHRISTINA	78	
CHUEN ON	5	
CITADEL HILL	55	
CITY OF MIDLAND	19	108
CLIFFORD MAERSK	1	44
CO-OP EXPRESS I	52	
CO-OP EXPRESS II	37	
CO-OP EXPRESS V	31	62
COLIMA	3	107
COLORADO HIGHWAY	48	
COLUMBIA STAR		100
COLUMBUS AMERICA	174	
COLUMBUS AUSTRALIA	4	
COLUMBUS CALIFORNIA	108	
COLUMBUS LOUISANA	76	
COLUMBUS NEW ZEALAND	88	
COLUMBUS VICTORIA	99	
COLUMBUS VIRGINIA	99	
COLUMBUS WELLINGTON	92	
CONTINENTAL HIGHWAY	17	
CONTINENTAL LOTUS	14	
COPIAPO	4	

SHIP NAME	VIA RADIO	VIA MAIL
CORABANK	1	
CORNELIA MAERSK	10	54
CORNUCOPIA	32	123
CORONADO	82	45
COUNTESS-SKY	49	64
CPL. LOUIS J. HAUGE JR	13	37
CRYSTAL STAR	14	68
CURRENT	28	75
D.L. BOWER		103
DA MOSTO	16	79
DACEBANK	70	
DAIEI MARU	44	
DAMIAO DE GOIS	17	
DAVID PACKARD	1	
DAWN	58	115
DIANA	2	42
DOCK EXPRESS TEXAS	23	58
DOMINA	29	
DONA MAGDALENA	1	
DRAGOR MAERSK	20	61
DUBHE	25	42
DUSSELDORF EXPRESS	49	
DYUI SKAGERAK		56
E.R. BRUSSEL	22	
EASTERN ROYAL	56	50
EDGAR B. SPEER		47
ELBE MARU	106	
ELGAREN	91	
EMPIRE STATE	17	13
ENDEAVOR	23	126
ERNEST R. BREECH	81	168
ESTHER SCHULTE	21	
EVER GATHER		8
EVER GENERAL	7	7
EVER GENIUS	1	
EVER GENTLE	1	12
EVER GIANT	4	24
EVER GIFTED	3	5
EVER GIVEN	27	34
EVER GLEAMY	11	16
EVER GLOBE	6	24
EVER GLORY	8	
EVER GOLDEN	7	13
EVER GOODS		8
EVER GOVERN	7	24
EVER GRACE	8	7
EVER GRADE	7	6
EVER GRAND	6	9
EVER GROUP	1	12
EVER GROWTH		12
EVER GUARD	2	4
EVER GUEST	17	151
EVER GUIDE	3	
EVER LAUREL	7	
EVER LEVEL	24	37
EVER LIVING	6	10
EVER LOADING	19	39
EVER LYRIC	8	33
EVER SHINE	19	
EVER SUMMIT	30	125
EVER SUPERB	14	11
EVER TRUST	1	
EVER VALOR	13	139
EVER VALUE	5	19
EVER VIGOR	18	
EVER VITAL	2	13
EVERSPRING	17	36
EXPORT CHALLENGER	15	18
EXPORT CHAMPION	27	117
EXPORT FREEDOM	30	97
EXPORT PATRIOT	28	111
EXXON BALTIMORE	1	
EXXON BATON ROUGE	23	49
EXXON BAYTOWN	11	47
EXXON BENICIA	26	32
EXXON BOSTON	44	120
EXXON HOUSTON	32	79
EXXON JAMESTOWN	15	20
EXXON LEXINGTON	8	27
EXXON LONG BEACH	14	102
EXXON NEW ORLEANS	35	25
EXXON NORTH SLOPE	28	32
EXXON PHILADELPHIA	28	74
EXXON PRINCETON	12	14
EXXON SAN FRANCISCO	9	16
EXXON VALDEZ	2	10
EXXON WASHINGTON	10	35
FALCON LEADER	11	25
FALSTRIA	66	67
FEDERAL LAKES	51	102
FEDERAL SEAWAY	16	28
FERNCROFT	94	169
FETISH	56	
FIRST LT JACK LUMMUS	15	
FLORIDA RAINBOW	23	89
FORTALEZA	72	180
FRANCIS SINCERE NO. 6	33	
FRED R WHITE JR		49
FROTASIRIUS	2	
GALLEON AQUAMARINE	9	
GALVESTON	35	118
GAS LIBRA	1	
GEMINI	74	119
GENERAL M.BELGRANDO	1	
GENEVIEVE LYKES	18	77
GEORGE A. SLOAN	46	79
GEORGE H. WEYERHAEUSER	27	185
GEORGE WASHINGTON BRID	132	
GERONIMO		41
GLACIER BAY	39	71
GLOBAL FRONTIER	79	160
GLOBAL PIONEER	53	65
GLORIOUS SPICA	63	
GLORY SPIRIT	28	43
GOLD BOND CONVEYOR	1	
GOLDEN BLISS	45	
GOLDEN GATE	2	
GOLDEN GATE BRIDGE	53	69
GOLDEN GRAMPUS	16	
GOLDEN HAWK	29	152
GOLDEN HILL	4	22
GRACE ISLAND	9	
GREAT LAND	135	
GREAT OCEAN	13	
GREEN FOREST	12	
GREEN HARBOUR	31	
GREEN KOBE	23	35
GREEN MASTER	56	62
GREEN MAYA	43	55
GREEN RAINIER	20	
GREEN SASEBO	53	42
GREEN VALLEY	26	90
GREEN WAVE	55	92
GUAICURI	33	105
GULF IDEAL	15	
GYPSUM COUNTESS	166	
GYPSUM KING	248	
H,J, KAISOR		35
H.J. HAYNES		224
HAI JUNG	4	
HAKUSAN	41	
HAKUSAN MARU	134	
HANJIN BUSAN	15	30
HANJIN HONG KONG	3	8
HANJIN KOBE	10	16
HANJIN KWANGYANG	6	
HANJIN LONG BEACH	10	38
HANJIN POHANG	14	21
HANJIN SEOUL	3	12
HASSAN MERCHANT	90	119
HEERENGRASHT	25	
HENRY FORD II		55
HERBERT C. JACKSON	3	
HERMENIA	47	136
HIKAWA MARU	133	
HIRA MARU	113	
HIYOSHI MARU	52	
HOEGH CAIRN	8	30
HOEGH CLIPPER	16	64
HOEGH DENE		48
HOEGH DUKE	11	
HOEGH DYKE	2	52
HOEGH MARLIN	2	20
HOEGH MASCOT	13	168
HOEGH MINERVA	42	34
HOEGH MIRANDA	21	70
HONSING BREEZE	42	129
HOLIDAY		177
HOMERIC	14	
HONOLULU	101	
HRELJIN	5	
HYUGA MARU	51	
HYUNDAI #1	18	21
HYUNDAI #101	2	11
HYUNDAI #18	8	
HYUNDAI #6	1	
HYUNDAI #7	16	7
HYUNDAI CHALLENGER	1	184
HYUNDAI EXPLORER	9	68
HYUNDAI ISLAND		13
HYUNDAI PIONEER	1	8
IBIS ARROW		63
INGER	37	132
IRVING ARCTIC	79	
IRVING MIAMI	4	
ISLAND HOPE		167
ISLAND PRINCESS	79	
ITALICA	10	10
J.A.W. IGLEHART	5	78
J.L. MAUTHE	5	34
J.T. HIGGINS		197
JACBAR		9
JADRAN	1	
JALAVIJAYA	5	
JALISCO	7	62
JAMES LYKES	10	131
JAPAN ALLIANCE	101	101
JAPAN APOLLO	59	95
JEAN LYKES	15	29
JOHN A. MCCONE		31
JOHN G. MUNSON	56	68
JOSEPH L. BLOCK		124
JOSEPH LYKES	20	
JOVIAN LILY	43	85
JOVIAN LUZON	18	24
JUBILEE	2	24
JUTHLANDIA	1	
KALAYAAN	72	21
KALIDAS	41	56
KAMNIK	2	
KASINA	45	70
KASTURBA	47	50
KAUAI	68	124
KEISHO MARU	37	135
KEN TRADER	85	
KENAI		75
KENNETH E. HILL	13	55
KENNETH T. DERR	17	126
KENT	46	124
KEYSTONE CANYON	25	167
KEYSTONER	24	174
KITTANNING	11	
KOFUKU MARU	23	86
KOLN EXPRESS	38	
KOREAN JACEWON	26	36
KOREAN WONIS JIN	23	5
KOREAN WONIS ONE	31	46
KOREAN WONIS SEVEN	20	21

SHIP NAME	VIA RADIO	VIA MAIL
KOREAN WONIS SUN	11	31
KUROBE MARU	8	
LA PAMPA	9	
LANAI	78	
LANCASHIRE	1	
LARS MAERSK	29	95
LAURA MAERSK	20	86
LAURA S	1	
LAUST MAERSK	17	60
LAWRENCE A. GIANELLA	27	
LEDA MAERSK	35	104
LEISE MAERSK	31	74
LERMA	85	
LESLIE LYKES	7	81
LETITIA LYKES	25	21
LEWIS WILSON FOY		286
LEXA MAERSK	29	66
LIBERTADOR GRAL SAN MA	5	16
LICA MAERSK	47	43
LILLOOET	26	108
LING LEO	16	187
LONG BEACH	36	91
LOTUS ACE	89	
LOUIS MAERSK	27	46
LOUISE LYKES	47	70
LPG HARDANGER		40
LT. ODYSSEY	17	
LUCENT STAR	38	39
LURLINE	53	210
LUZON	30	97
LUZON VICTORY	20	
LYRA	26	66
M. P. GRACE	53	
M.S. NOSAC SKAUKAR	24	137
M.V. BONDAD	27	46
M.V. IBIS ARROW	45	41
M.V. MANYAS #1	64	40
M.V. OCEAN WCKY	11	68
MAAM		77
MADAME BUTTERFLY	43	132
MADANG	4	
MAERSK WAVE	26	74
MAJ SANDVED	43	122
MAJ. STEPHEN W. PLESS	9	8
MALLORY LYKES	8	32
MANGAL DESAI	15	
MANHATTAN	20	
MANUKAI	69	146
MANULANI	70	60
MARABANK	5	
MARATHA MARINER	14	26
MARATHA MELODY	79	
MARATHA SHOGUN	10	
MARCHIONESS	16	
MARGARET LYKES	93	249
MARIA TOPIC	13	
MARIF	26	27
MARITIME NOBLE	95	
MARJORIE LYKES	17	63
MAUI	67	175
MC KINNEY MAERSK	23	67
MEDALLION	44	39
MEDUSA CHALLENGER	52	119
MELVILLE	105	199
MENINA BARBARA	27	60
MERAK EIGHTY	28	18
MERIDA	14	19
MESABI MINER		114
MICROBA	25	71
MICRONESIAN COMMERCE	23	
MICRONESIAN INDEPENDEN	138	121
MIDDLETOWN	67	114
MILTA	19	84
MING GLORY	7	
MING MOON	17	18
MING OCEAN	20	33
MING PEACE		21
MING PROMOTION		37
MING PROPITIOUS	10	74
MING SPRING	23	27
MING STAR	1	
MING SUN	5	45
MOANA PACIFIC	193	89
MOBIL ARCTIC	22	201
MOBIL MERIDIAN	62	113
MOKU PAHU	26	139
MORMACSKY	37	119
MORMACSTAR	31	98
MORMACSUN	4	36
MOSAC BRANCO	60	86
MOSEL EXPRESS	96	
MV BANGLAR MAMATA		86
MV GREEN ANGELES	35	61
MV JEBELAU	30	108
MV MARGARITA	30	194
MV MARLIN	39	169
MV TRUDY	36	
MV WESTWOOD BELINDA	3	27
MYRON C. TAYLOR	21	
NANCY LYKES	9	64
NATIONAL DIGNITY	30	165
NATIONAL HONOR	12	69
NATIONAL INTEGRITY	3	52
NATIONAL PRIDE	14	
NAVIOS ENTERPRISE	22	11
NEDLLOYD ELBE	94	
NEDLLOYD KATAJK	117	
NEDLLOYD KEMBLA	30	
NEDLLOYD KIMBERLEY	67	
NEDLLOYD KINGSTON	112	
NEDLLOYD KYOTO	54	
NEDLLOYD ROCHESTER	91	
NEDLLOYD ROSARIO	78	
NEDLLOYD ROTTERDAM	103	
NEDLLOYD ROUEN	100	
NEPTUNE ACE	58	
NEPTUNE AMBER	67	166
NEPTUNE CORAL	94	
NEPTUNE DIAMOND	194	103
NEPTUNE GARNET	28	
NEPTUNE IVORY	111	
NEPTUNE KIKU	55	
NEPTUNE LEO	5	
NEPTUNE PEARL	90	68
NEPTUNE TOURMALINE	6	
NEW HORIZON		66
NEW INDEPENDENCE	54	125
NEW JERSEY MARU	131	
NEW YORK MARU	116	
NISSAN LAUREL	93	
NISSAN MARU	23	
NOAA DAVID STARR JORDA	134	173
NOAA SHIP ALBATROSS IV	236	366
NOAA SHIP CHAPMAN	303	460
NOAA SHIP DAVIDSON	205	334
NOAA SHIP DELAWARE II	238	374
NOAA SHIP DISCOVERER O	99	6
NOAA SHIP FAIRWEATHER	291	322
NOAA SHIP FERREL	26	
NOAA SHIP HECK 591	8	22
NOAA SHIP JOHN N COBB	75	102
NOAA SHIP MCARTHUR	82	20
NOAA SHIP MILLER FREEM	340	537
NOAA SHIP OCEANOGRAPHE	83	
NOAA SHIP OREGON II	311	337
NOAA SHIP RAINIER	127	
NOAA SHIP RESEARCHER	329	450
NOAA SHIP RUDE 590	11	36
NOAA SHIP SURVEYOR	137	
NOAA SHIP T. CROMWELL	275	372
NOAA SHIP WHITING	91	160
NOORDAM	41	
NORDHVAL	82	59
NORTHERN HIGHWAY	1	
NOSAC EXPRESS	3	29
NOSAC SEL	52	243
NOSAC TAKARA	31	
NOSAC TAKAYAMA	172	245
NOSAC TRIGGER	33	
NOSAC VERDE	16	50
NURNBERG EXPRESS	49	
OAK GLORY	23	56
OAK PEARL	14	
OAK SUN	40	
OAKLAND	119	160
OBERON	17	22
OCEAN BRIDGE	2	
OCEAN CHEER	2	3
OCEAN COMMANDER #1	53	28
OCEAN DIANA	9	
OCEAN LEGEND	3	
OCEAN STEELHEAD	109	239
OCTA	28	61
OJI GLORIA	29	
OLEANDER	131	195
OLIVE ACE	47	202
OMI DYNACHEM	37	124
ORANGE ACE	20	
ORCHID		11
ORCHID #2	11	24
OREGON RAINBOW	19	145
ORIENTAL DIPLOMAT	20	1
ORIENTAL EDUCATOR	82	273
ORIENTAL EXECUTIVE	50	204
ORIENTAL EXPLORER	79	136
ORIENTAL FAIR	19	184
ORIENTAL FAITH	3	26
ORIENTAL FORTUNE	28	77
ORIENTAL FRIENDSHIP	57	119
ORIENTAL KNIGHT	12	
ORIENTAL MINISTER	13	12
ORIENTAL PATRIOT	28	123
ORIENTAL PHOENIX	4	234
ORIENTAL PRINCE	91	
ORIENTAL TAIO	20	
ORION HIGHWAY	42	53
OVERSEAS ALICE	18	87
OVERSEAS BOSTON	11	13
OVERSEAS CHICAGO	6	9
OVERSEAS HARRIET	6	55
OVERSEAS JUNEAU	25	74
OVERSEAS MARILYN	19	43
OVERSEAS NEW YORK	8	34
OVERSEAS OHIO	14	
OVERSEAS VALDEZ	33	
OVERSEAS VIVIAN	17	30
OVERSEAS WASHINGTON	28	122
PACBARON	13	
PACBARONESS	34	32
PACDUCHESS	22	
PACDUKE	2	
PACEMPEROR	20	32
PACGLORY	9	
PACIFIC ANGEL	35	35
PACIFIC ARROW	84	87
PACIFIC CLIPPER	22	
PACIFIC DOWN	1	241
PACIFIC HIGHWAY	65	18
PACIFIC PRINCESS	34	
PACIFIC PROGRESS		17
PACIFIC RAINBOW	78	212
PACIFIC VENTURE	164	
PACIFIC VICTORY	44	29
PACIFIC WING	43	
PACKING	21	
PACMAJESTY	16	
PACMERCHANT	11	
PACMONARCH	6	11
PACPRINCE	8	
PACPRINCESS	24	29

SHIP NAME	VIA RADIO	VIA MAIL
PALM ACE	25	
PANAMA	25	
PANCALDO	11	
PATRIOT	41	47
PAUL BUCK	42	93
PAUL H. TOWNSEND	2	
PAUL PIGOTT	1	
PAUL THAYER		76
PECOS	10	
PEGGY DOW	100	
PENNSYLANIA RAINBOW	1	145
PENNSYLVANIA TRADER	14	65
PERUVIAN REEFER		43
PETERSBURG	9	9
PETERSFIELD	59	
PFC EUGENE A. OBREGON	38	18
PFC WILLIAM B. BAUGH	1	33
PFC. JAMES ANDERSON JR	11	37
PHILADELPHIA	30	114
PHILIP R. CLARKE	28	45
PHILIPPINE VICTORY	14	
PILAR	9	103
PLANTIN	58	
POLAR ALASKA	4	136
POLYNESIA	142	101
PONCE	16	
POTOMAC TRADER	9	
PRESIDENT ADAMS	17	50
PRESIDENT ARTHUR	50	200
PRESIDENT BUCHANAN	29	144
PRESIDENT CLEVELAND	1	
PRESIDENT EISENHOWER	99	189
PRESIDENT F. ROOSEVELT	48	153
PRESIDENT FILLMORE	21	82
PRESIDENT GARFIELD	27	54
PRESIDENT GRANT	8	92
PRESIDENT HARDING	41	124
PRESIDENT HOOVER	47	158
PRESIDENT JACKSON		12
PRESIDENT JEFFERSON	35	101
PRESIDENT JOHNSON	55	165
PRESIDENT KENNEDY	9	21
PRESIDENT LINCOLN	67	184
PRESIDENT MADISON	39	17
PRESIDENT MC KINLEY	50	151
PRESIDENT MONROE	62	126
PRESIDENT PIERCE	52	187
PRESIDENT TYLER	73	131
PRESIDENT VAN BUREN	11	66
PRESIDENT WASHINGTON	111	222
PRESIDENT WILSON	33	67
PRESQUE ISLE		98
PRIMORE	19	37
PRINCE OF TOKYO	59	173
PRINCESS DIAN	14	46
PROSPERIDAD	58	173
PUERTO RICO	21	
PVT HARRY FISHER	11	
QUEEN ELIZABETH 2	55	
QUEEN OPAL	25	12
QUEENS WAY BRIDGE	39	
RAINBOW BRIDGE	29	43
RAINBOW HOPE	7	158
RED ARROW	7	
REGINA MAERSK	15	65
RHEIN EXPRESS	70	
RICHARD G MATTIESEN	36	
RICHARD REISS	19	41
RIMBA SEPETIR	16	
RIO ESQUEL	59	21
RIO FRIO	51	
RIO GRANDE	4	
RIO LIMAY	73	24
RIO TEUCO	2	
ROACHBANK	26	
ROBERT CONRAD	7	
ROBERT E. LEE	13	
RODIN	100	
ROGER R. SIMONS	59	
ROMAN REEFER		16
ROSARIO DEL MAR	11	
ROSINA TOPIC	6	
ROSTAND	154	
ROTTERDAM	17	
ROUSSEAU	122	
ROYAL PRINCESS	57	
ROYAL SAPPHIRE	1	
ROYAL VIKING STAR	2	
RUTH LYKES	4	
RV CALANUS		12
S.S. BAYAMON	6	
S.S. PORTLAND	1	
S.S. ROVER	26	89
S.S.BEAVER STATE		43
S.S.OAKLAND		22
SAM HOUSTON	11	33
SAMOAN REEFER	112	208
SAN JUAN	68	190
SAN MATEO VICTORY	1	
SAN MIGUEL BAY	21	20
SANKO AZALEA	10	20
SANKO DIGNITY	11	
SANKO DILIGENCE	14	93
SANKO ETERNITY	11	
SANKO HAWK	20	
SANKO LAPIS	16	76
SANKO PEACE	56	90
SANKO PEACOCK	8	
SANKO PEARL	29	
SANKO STAR	1	
SANKO SWIFT	5	
SANKO TURQUOISE	1	
SANSINENA II	21	101
SANTA ADELA	59	145
SANTA CRUZ II	26	
SANTA JUANA	67	157
SATSUNA MARU	64	51
SATURN DIAMOND	39	
SAUDI DIRIYAM	17	
SAVANNAH	71	
SAVANNAH MARU	1	
SAVONITA	1	
SCANDINAVIAN HIGHWAY	97	
SEA BELLS	50	44
SEA DIAMOND	37	145
SEA FAN	50	105
SEA FORTUNE	39	140
SEA FOX		11
SEA JADE	27	13
SEA LANTERN	80	199
SEA LIGHT	28	100
SEA TRANSPORTER	111	
SEALAND ADVENTURER	63	169
SEALAND BOSTON	18	83
SEALAND CONSUMER	50	225
SEALAND DEFENDER	67	95
SEALAND DEVELOPER	60	139
SEALAND ECONOMY	32	165
SEALAND ENDURANCE	43	179
SEALAND EXPLORER	40	178
SEALAND EXPRESS	51	142
SEALAND FREEDOM	58	63
SEALAND INDEPENDENCE	62	127
SEALAND INNOVATOR	38	122
SEALAND LEADER	28	170
SEALAND LIBERATOR	36	155
SEALAND MARINER	51	178
SEALAND PACER	22	125
SEALAND PATRIOT	32	75
SEALAND PIONEER	30	147
SEALAND PRODUCER	53	126
SEALAND VENTURE	60	137
SEALAND VOYAGER	45	164
SEDCO/BP 471	62	
SEVEN OCEAN	36	60
SGT WILLIAM R BUTTON	2	91
SGT. METEJ KOCAK	1	
SHELDON LYKES	58	140
SHELLY BAY	12	
SHENAHON	29	35
SHIN BEISHU MARU	22	
SHINKASHU MARU	43	
SHIRLEY LYKES	26	135
SILVER SORREL	48	36
SILVER STAR	23	39
SIOUX TATE	41	
SKANDERBURG	17	34
SKAUBORD	63	185
SKAUGRAN	82	169
SKRIM	164	
SOARER CUPID	53	
SOARER DIANA	42	212
SOLON TURMAN	4	
SONORA		39
SOPHIA	68	
SOUTHLAND STAR	114	
SPRING BEAR	37	
SPRING BIRD	19	42
SPRING BREEZE		38
SS GENEVIEVE LYKES		23
SS MAUNALEI	30	111
STAR DIEPPE	42	
STAR EAGLE	17	45
STAR GRAN	2	23
STAR HONGKONG	65	
STAR KANDA	13	6
STAR OF TEXAS	49	
STAR THAILAND	15	65
STARWARD		4
STATE OF MAINE	27	
STELLA LYKES	36	69
STEWART J. CORT		147
STONEWALL JACKSON	14	32
STRATHCONON	76	
STREAM BUSUANGA	1	
STRIDER	12	75
STRIDER CRYSTAL	21	242
STUTTGART EXPRESS	46	
SUGAR ISLANDER		52
SUN PRINCESS	36	
SUN VIKING	14	58
SUNBELT DIXIE	101	119
SUNORA	36	
SUNSET PEAK	18	
SYOSSET	6	
T AKASAKA	1	
TABASCO	29	81
TAI CORN	15	
TARGET	51	76
TENCHBANK	8	
TEPOZTLAN	19	
TESTER	56	23
TEXACO FLORIDA	9	
TEXACO GEORGIA	10	
TEXACO RHODE ISLAND	34	12
TEXAS CLIPPER	1	
TFL DEMOCRACY	11	75
TFL ENTERPRISE	36	61
TFL EXPRESS	12	10
TFL FREEDOM	28	19
TFL INDEPENDENCE	17	117
TFL ITALY	78	
TFL JEFFERSON	1	
TFL LIBERTY	29	112
THOMAS G. THOMPSON	184	64
THOMAS WASHINGTON	65	293
THOMPSON LYKES	19	87
THOMPSON PASS		100
TOHBEI MARU	110	49
TOKYO MARU	29	
TOKYO RAINBOW	62	

SHIP NAME	VIA RADIO	VIA MAIL
TONIC VENTURE	1	
TONSONIA	27	62
TOWER BRIDGE	31	
TOYOTA MARU NO 17	18	
TOYOTA MARU NO 18	40	
TRAVE ORE	37	74
TRI HEXAGON		109
TROPIC SUN	1	
TROPICAL BEAUTY	12	34
TROPICAL MIST	1	
TROPICALE	8	60
TULSIDAS	7	13
TUNISIAN REEFER	1	
TYSON LYKES	2	52
ULTRAMAR	27	32
ULTRASEA	7	20
UNAMONTE	1	
UNICORN		41
UNITED HOPE	35	54
UNITED SPIRIT	24	41
UNIVERSE	4	16
USCGC ACACIA (WLB406)	19	
USCGC ACTIVE WMEC 618	10	
USCGC ALERT (WMEC 630)	29	91
USCGC BASSWOOD (WLB 38	31	11
USCGC BISCAYNE BAY	1	
USCGC BLACKHAW (WLB 39	28	
USCGC CAPE SHOALWATER	1	4
USCGC CHASE (WHEC 718)	1	49
USCGC CHEROKEE WMEC 16	38	77
USCGC CHILULA (WMEC 15	1	
USCGC COURAGEOUS	1	
USCGC DAUNTLESS WMEC 6	1	
USCGC DEPENDABLE	9	
USCGC EAGLE (WIX 327)	12	
USCGC EVERGREEN WMEC 2	2	16
USCGC FIREBUSH WLB 393	1	
USCGC GALLATIN WHEC 72	5	
USCGC GLACIER (WAGB 4)	25	53
USCGC HARRIET LANE	6	
USCGC INGHAM (WHEC 35)	2	
USCGC IRONWOOD (WLB 29	42	
USCGC JARVIS (WHEC 725	14	
USCGC KATMAI BAY	26	
USCGC MACKINAW	16	
USCGC MALLOW (WLB 396)	34	68
USCGC MESQUITE (WLB 30	8	
USCGC MIDGETT (WHEC 72		37
USCGC MORGENTHAU	137	
USCGC NORTHWIND WAGB 2	11	13
USCGC PLANETREE WLB 30	11	
USCGC POLAR STAR WAGB	6	38
USCGC RUSH (WHEC 723)		99
USCGC SALVIA (WLB 400)	14	
USCGC SEDGE (WLB 402)	22	
USCGC STORIS (WMEC 38)	2	
USCGC SUNDEW (WLB 404)	17	
USCGC SWEETBRIER WLB 4	46	26
USCGC SWEETGUM (WLB 30	1	
USCGC TAMAROA (WMEC 16	1	
USCGC TAMPA WMEC 902	11	
USCGC UNIMAK (WTR 379)	8	
USCGC UTE		11
USCGC VIGILANT WMEC 61	24	44
USCGC VIGOROUS WMEC 62	3	66
USCGC WOODRUSH (WLB 40	1	
USCGC YOCONA (WMEC 168	137	153
USNS ALTAIR	3	
USNS APACHE (T-ATF 172	19	20
USNS BARTLETT(T-AGOR 1	8	
USNS CHAUVENET	54	
USNS DE STEIGUER	1	
USNS GUS W. DARNELL	42	
USNS HARKNESS (T-AGS 3	3	9
USNS INVISIBLE		48
USNS KANE TAGS 27	10	
USNS KAWISHIWI	4	
USNS MERCURY	49	60
USNS MISSISSINEWA		53
USNS MOHAWK (T-ATF 170	11	10
USNS NARRAGANSETT	103	151
USNS NAVAJO	91	
USNS NEOSHO (T-AO 143)		74
USNS PASSUMPSIC TAO 10		83
USNS PAWCATUCK TAO-108		175
USNS POLLUX	27	87
USNS PONCHATOULA		39
USNS POWHATAN TATF 166	52	66
USNS REDSTONE	17	
USNS SEALIFT ANTARCTIC	43	53
USNS SEALIFT ARABIAN S	3	8
USNS SEALIFT ARCTIC	5	34
USNS SEALIFT ATLANTIC	1	
USNS SEALIFT CARIBBEAN	38	
USNS SEALIFT CHINA SEA	47	90
USNS SEALIFT IND'N OCE	8	40
USNS SEALIFT MED	45	133
USNS SPICA (T-AFS 9)	193	177
USNS VANGUARD TAG 194	66	106
USNS WACCAMAW(TAO-109)		95
VALLEY FORGE	17	77
VAN ENTERPRISE	34	
VAN TRADER	57	159
VICTORY ACE	18	
VISHVA PANKAJ	18	
VISHVA PAROG	17	
VISHVA PRAFULLA	1	68
VISHVA SIDDHI	19	
WALCHAND	1	
WASHINGTON HIGHWAY	113	66
WASHINGTON RAINBOW #2	27	124
WASHINGTON TRADER	1	
WECOMA		130
WELLINGTON STAR	145	
WESER EXPRESS	18	
WESTERN HIGHWAY	2	
WESTERN SUN	35	84
WESTIN WON	2	
WESTOCEAN	444	
WESTWARD VENTURE	29	60
WESTWOOD ANNETTE	4	99
WESTWOOD MARIANNE	8	85
WESTWOOD MERCHANT		43
WILFRED SYKES	148	238
WILLIAM E. MUSSMAN	17	91
WILLIAM J. DELANCEY		187
WILLIAM R. ROESCH		114
WILLOWBANK	89	
WINTER STAR	90	116
WINTER SUN	21	18
WOLVERINE		68
WORLD WING #2	81	
YAMASHIN MARU	95	53
YOUNG SCOPE	77	
YOUNG SKIPPER	40	45
YOUNG SPORTSMAN	8	80
YOUNG SPROUT	41	101
YS ARGOSY	45	74
ZAPATA ARCTIC	11	
ZEELANDIA	41	
ZEYNEP-K	12	
ZIM GENOVA	26	
ZIM HAIFA	36	
ZIM HONGKONG	13	
ZIM HOUSTON	23	
ZIM IBERIA	47	
ZIM KEELUNG	39	
ZIM MARSEILLES	9	
ZIM MIAMI	45	
ZIM NEW YORK	26	
ZIM SAVANNAH	54	
ZIM TOKYO	30	

SUMMARY: GRAND TOTAL VIA RADIO 37150

GRAND TOTAL VIA MAIL 56404

TOTAL UNIQUE OBS 77248

TOTAL DUPLICATES 16306 (21.1%)

UNIQUE RADIO OBS.20844 (27.0%)

UNIQUE MAIL OBS. 40098 (51.9%)

Top ship radio — *Westocean*

Top ship mail — *Miller Freeman*

Bathy-Tesac Data Received at NMC

April, May and June 1987

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
A8VI	20	20	0	PACDUCHESS
A8YI	5	5	0	PACBARON
BNPK	36	36	0	JEDI
BNRB	33	33	0	***
BNSC	2	2	0	XIANG YANG HONG 16
CBAK	16	16	0	***
CCES	5	5	0	***
CGBV	158	0	158	DAWSON
CGCL	32	0	32	BAFFIN
CGDG	45	45	0	HUDSON
CGDV	488	488	0	W. TEMPLEMAN
CG2683	35	35	0	ALFRED NEEDLER
CSBL	9	9	0	DAMIAO DE GOIS
CSHIP	26	26	0	***
CYWK	35	35	0	ENDEAVOR
C7C	275	0	275	OCEAN STATION CHARLIE
C7L	140	140	0	OCEAN STATION LIMA
DBFJ	62	62	0	FRITHJOF
DBFP	4	4	0	WALTHER HERWIG
DCH	12	12	0	ELBE I
DDVK	4	4	0	CALBE
DGFR	45	45	0	MONTE OLIVIA
DGLM	78	78	0	MONTE ROSA
DGRL	59	59	0	RIKA
DGSR	16	16	0	MONTE SARMIENTO
DGVK	77	77	0	COLUMBIA VICTORIA
DGZV	97	97	0	COLUMBUS VIRGINIA
DHCW	64	64	0	COLUMBUS WELLINGTON
DHOU	18	18	0	***
DLEZ	6	6	0	***
DZLI	27	27	0	***
DZVJ	1	1	0	***
DZVK	3	3	0	***
D5BC	7	7	0	SEDCO/BP471
D5CW	2	2	0	SOUTH GLORY
D5NE	61	61	0	MT. CABRITE
D5NZ	90	90	0	POLYNESIA
ECHZ	3	3	0	***
ELBX3	5	5	0	PACKING
ELDW8	32	32	0	SKRIM
ELED7	3	3	0	PACPRINCE
ELED8	37	37	0	PACPRINCESS
EMZY	1	1	0	***
EREA	298	193	105	MONSOON
EREB	220	161	59	VOLNA
EREC	70	6	64	PRYLYV
EREH	109	0	109	PRIBOI
EREI	293	123	170	OCEAN
ERES	149	127	22	VICTOR BUGAEN
ERET	9	9	0	GEORGE OUSHAKOV
EREU	102	100	2	ERNST KRENKEL
ESGG	23	0	23	FROLOV VYACHESLAV
ESGU	379	6	373	PERCY 3
EVPW	2	2	0	***
EWAU	1	1	0	***
EWUZ	2	2	0	***
FNCW	68	68	0	ROUSSEAU
FNDL	2	2	0	***
FNDS	4	4	0	***
FNDT	24	24	0	***
FNDU	34	34	0	ZAMBEZE
FNDZ	17	17	0	ZELANDE
FNFD	3	3	0	***
FNGR	1	1	0	***
FNGS	44	44	0	LAFAYETTE
FNIB	3	3	0	THALASSA

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
FNLA	1	1	0	SABINIA
FNOM	50	50	0	ANGO
FNPA	34	34	0	***
FNQB	30	30	0	***
GACA	26	26	0	***
GNAM	56	56	0	CIROLANA
GPHH	41	41	0	FARNELLA
GXYY	48	48	0	***
GYRW	18	18	0	ENCOUNTER BAY
GZKA	10	10	0	***
HCGT	6	6	0	BUCCANEER
HLFX	1	1	0	PACBART
HPAN	37	37	0	MICRONESIAN COMMERCE
HBDY	28	28	0	CAP ANAMUR
H9BQ	77	77	0	MICRONESIAN INDEPENDENCE
JASQ	62	62	0	HIYOSHI MARU
JAWD	36	36	0	AMBASSADOR BRIDGE
JBES	64	64	0	YAMASHIN MARU
JBMS	106	106	0	HIKAWA MARU
JBOA	30	30	0	KEIFU MARU
JCCX	22	22	0	***
JCDF	40	40	0	SOYO MARU
JCDT	46	46	0	AMERICA MARU
JCIN	60	60	0	TOKYO MARU
JCOD	52	52	0	SHOYU MARU
JFDG	118	118	0	SHUMPU MARU
JGZK	113	113	0	RYOFU MARU
JIOW	61	61	0	ALASKA MARU
JJHH	8	8	0	***
JJZC	39	39	0	HAKONE MARU
JNVF	305	305	0	KAIYO MARU
JPVB	71	71	0	SEIFU MARU
JQXW	77	77	0	HIERU MARU
KDBG	42	42	0	PRESIDENT LINCOLN
KEOC	94	94	0	EDGAR M. QUEENY
KGWT	74	74	0	THOMPSON, T.G.
KGWU	126	126	0	WASHINGTON, T.
KIYO	22	22	0	EXXON JAMESTOWN
KNBD	61	61	0	DELAWARE II
LOPD	3	3	0	***
NAAO	24	24	0	GLACIER
NACI	1	1	0	***
NAQD	16	16	0	JARVIS
NARK	4	4	0	***
NAVOC	9	9	0	***
NBKW	1	1	0	***
NBTM	8	8	0	CGC POLAR STAR
NDNR	15	15	0	***
NDWA	52	52	0	MORGENTHAU
NFKQ	2	2	0	SEALIFT ARABIAN SEA
NHWR	8	8	0	MIDGETT
NIKA	4	4	0	USNS SEALIFT ATLANTIC
NIKL	89	89	0	TAMPA
NLGF	68	68	0	NORTHLAND WMEC 904
NLVS	32	32	0	RUSH
NMOB	8	8	0	***
NQST	22	22	0	***
NRL1	12	12	0	***
NYGG	46	46	0	CHAUVENET
NZSR	1	1	0	***
NZXF	1	1	0	SAMPSON
OFXB	17	17	0	***
OXFB	6	6	0	LEXA MAERSK

Bathy-tesac Data Received at NMC cont'd

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
OXMD	45	45	0	LARS MAERSK
OXYL	28	28	0	BAMSA DAN
OYBG	42	42	0	FALSTRIA
PACM	6	6	0	PACIFIC MISSILE RANGE
PGDF	21	21	0	NEDLLOYD KATWIJK
PGDG	62	62	0	NEDLLOYD KINGSTON
PGDM	1	1	0	NEDLLOYD LINGE
PGDS	14	14	0	NEDLLOYD KYOTO
PGOF	17	17	0	NEDLLOYD KEMBLA
PJYG	77	77	0	OLEANDER
PLAT	256	256	0	PLATFORM
PWGK	6	6	0	***
SCOU	2	2	0	TV 244
SCPE	6	6	0	TV 253
SCPH	3	3	0	***
SCPI	4	4	0	***
SCPK	1	1	0	TV 260
SCQG	3	3	0	***
SEXN	2	2	0	TV 227
SGQJ	36	36	0	ELGAREN
SHPF	1	1	0	TV 281
SJTR	1	1	0	TV 271
SKVP	13	13	0	***
SKVQ	2	2	0	***
SLDN	1	1	0	***
SLRI	2	2	0	***
SMZQ	1	1	0	TV 102
TEST	5	5	0	***
TFEA	15	15	0	BJARNI SAEMUNDSSON
TFXQ	16	16	0	RAKKAFOSS
UAAX	45	5	40	VOYKOV
UBNZ	125	120	5	SHULEYKIN AKADEMIK
UEAK	223	111	112	VALERIAN URYVAYEV
UFJJ	6	6	0	***
UFLR	2	2	0	BOGUSLAV
UGBU	2	2	0	***
UGXM	1	1	0	***
UHLK	5	5	0	***
UHMN	2	0	2	***
UHQC	1	0	1	***
UHQS	154	24	130	ACADEMIC KOROLEV
UJFO	135	134	1	MULTANOVSKIY PROF
ULRL	1	1	0	***
UMAY	48	7	41	ACADEMIC SHIRSHOV
UMFW	86	86	0	PROF. ZUBOV
UNGG	1	1	0	***
UNNR	1	1	0	***
UPUI	49	49	0	PROFESSOR VIZE
UQHM	24	4	20	***
UQXM	2	1	1	***
URYM	39	1	38	RUDOLF SAMOILOVICH
USOP	3	3	0	NIKOLAI KONONOV
UUPB	203	67	136	AKADEMIK N. SHOKALSKIY
UUQQ	1	1	0	***
UUQR	14	14	0	MOLOHANOV PAVEL PRO
UURB	15	5	10	PAMIR
UUVN	2	1	1	***
UVMJ	15	15	0	VSEVOLOD BERYOZKIN
UVMM	247	180	67	YAKOV GAKKEL
UWEC	124	47	77	KHROMOV PROFESSOR
UWNZ	1	1	0	KRASNOPEREKOPSK

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
UZGH	146	146	0	PASSAT
VCBT	60	60	0	CAPE ROGER
VC945	28	28	0	GADUS ATLANTICA
VJBQ	28	28	0	ANRO AUSTRALIA
VKCN	74	74	0	CANBERRA
VKCV	126	126	0	DERWENT
VKDA	88	88	0	***
VKLA	153	153	0	ADELAIDE
VKLB	28	28	0	HOBART
VKMK	125	125	0	***
VKML	215	215	0	SNIPE
VKMN	173	173	0	TEALE
VKMS	121	121	0	COOK
VKPM	24	24	0	***
VLNB	149	149	0	TORRENS
VMAP	187	187	0	AUSTRALIAN PROGRESS
VP45	28	28	0	AIRCRAFT
VP49	156	156	0	AIRCRAFT
VTNB	1	1	0	***
VXNB	352	352	0	AIRCRAFT
WA211	47	47	0	ALASKA
WCGN	10	10	0	CHEVRON CALIFORNIA
WDAG	21	21	0	SHENAHON
WECB	170	170	0	MELVILLE
WHBA	52	52	0	R.D.CONRAD
WMVC	19	19	0	J.N.COBB
WMVF	107	107	0	ALBATROSS IV
WSC22	20	20	0	POINT SUR
WTDF	126	126	0	T. CROMWELL
WTDK	54	54	0	C.S. JORDAN
WTDM	63	63	0	M.FREEMAN
WTDO	135	135	0	OREGON II
WTEA	19	19	0	DISCOVERER
WTEB	65	65	0	FAIRWEATHER
WTED	146	146	0	CHAPMAN
WTEF	17	17	0	RAINIER
WTEJ	14	14	0	MC ARTHUR
WTEK	26	26	0	DAVIDSON
WTEP	83	83	0	OCEANOGRAPHER
WTER	274	274	0	RESEARCHER
WTES	56	56	0	SURVEYOR
WTEW	5	5	0	WHITING
WXBR	42	42	0	CHEVRON MISSISSIPPI
WXQ7334	37	37	0	PETER ANDERSON
WYR44	53	53	0	***
WYR7512	5	5	0	BALD EAGLE
WYR9891	48	48	0	SEA HAVEN
WZE3929	73	73	0	MOANA WAVE
XXXX	1274	1261	13	NO SHIP CALL SIGN REC'D
Y3CH	25	0	25	PROF. ALBRECHT PENCK
ZCSK	36	36	0	***
ZMCR	11	11	0	***
ZMHD	1	1	0	***
3FHI2	128	128	0	MOANA PACIFIC
5LFX	36	36	0	PACBARONESS
5MCB	3	3	0	PACMERCHANT
7JOB	93	93	0	SHINKASHU MARU
7KDD	18	18	0	YOKO MARU
8JNZ	100	100	0	KOFU MARU
9VUU	8	8	0	CHIEH SHENG

TOTAL BATHYS RECEIVED 12608
TOTAL TESACS RECEIVED 2112
TOTAL REPORTS RECEIVED 14720

U. S. NDBC Climatological Data

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APRIL 1987

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN WAVE HT (M)	MAX WAVE HT (M)	MAX WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
32302	18.0S	085.1W	662	22.0	23.4	2.2	4.0	26/03	12.3	SE	23.3	19/09	1014.4
41001	34.9N	072.9W	720	18.2	21.8	2.4	5.7	27/08	13.1	S	27.9	17/07	1012.2
41002	32.2N	075.3W	720	19.1		2.1	4.9	04/15	13.2	NW	25.4	08/07	1013.6
42001	25.9N	089.7W	719	20.4	22.0	0.6	2.7	03/22	8.3	N	25.4	14/14	1016.7
42002	26.0N	093.5W	720	21.1	23.3	0.8	3.4	03/15	10.2	N	27.2	14/10	1017.1
42003	26.0N	085.9W	573	22.3	25.9	0.7	2.1	17/06	4.4	N	16.7	12/21	1017.2
42014	29.3N	087.4W	492	17.5	19.3				10.2	W	31.1	14/14	1015.1
42015	30.2N	088.2W	204	21.3	21.3				8.5	N	17.5	25/02	1016.7
42107	30.1N	088.9W	718	18.3	18.5	0.3	1.1	03/09	10.3	W	29.1	15/04	1016.3
44004	38.5N	070.6W	719	13.5	14.7	2.6	6.2	01/02	0.0	N			1013.1
44005	42.7N	068.3W	720	4.6	4.0	2.0	5.8	14/08	12.1	E	29.6	13/20	1014.8
44007	43.5N	070.1W	159	5.0	4.7	1.5	5.1	29/10	7.1	N	23.3	28/12	1015.7
44008	40.5N	069.5W	717	7.0	5.6	2.1	5.7	01/07	13.6	NE	36.9	14/01	1012.8
44009	38.5N	074.6W	719	8.2	7.6	1.6	4.5	26/02	13.1	NE	38.9	25/15	1013.6
44011	41.1N	066.6W	716	7.8	5.5	2.4	5.7	14/20	12.0	E	28.3	14/11	1013.9
44012	38.8N	074.6W	713	8.0	7.7	1.5	4.2	01/00	14.0	NE	35.0	25/09	1013.8
44013	42.4N	070.8W	719	6.1	5.5	1.2	4.5	13/16	11.0	N	36.9	13/21	1014.4
45001	48.0N	087.7W	714	3.4		0.5	2.7	01/19	9.6	SE	23.7	27/16	1016.3
45002	45.3N	086.4W	449	4.9	3.0	0.7	2.1	29/06	9.2	NE	23.3	30/00	1016.3
45003	45.3N	082.8W	687	3.5	2.6	0.6	3.2	01/22	9.3	N	27.2	01/18	1015.6
45004	47.6N	086.5W	534	3.7	2.3	0.6	3.5	27/23	7.9	SE	25.3	27/21	1015.4
45005	41.7N	082.4W	505	7.2	5.6	0.5	2.0	23/03	7.6	E	29.1	27/20	1015.0
45006	47.3N	089.8W	549	4.1	2.0	0.3	1.8	12/10	6.2	NE	19.4	12/05	1015.5
45007	42.7N	087.1W	718	4.8	3.5	0.8	3.8	02/12	9.9	N	29.1	02/05	1014.9
45008	44.3N	082.4W	697	3.5	2.0	0.7	3.3	05/07	9.1	N	27.2	02/20	1015.4
46001	56.3N	148.3W	719	3.9	4.8	2.9	7.1	10/03	14.6	NE	33.9	10/02	999.1
46002	42.5N	130.4W	030	11.6	13.0	1.8	2.3	30/23	7.7	SW	18.9	30/20	1008.8
46003	51.9N	155.9W	717	3.5	4.3	3.6	9.2	19/02	14.7	W	33.3	14/15	1001.1
46004	50.9N	135.9W	719	6.9	7.3	3.8	10.6	16/06	16.6	SW	33.8	16/03	1008.5
46005	46.1N	131.0W	718	9.2	9.9	3.2	7.3	08/07	13.1	S	26.9	08/01	1017.1
46006	40.8N	137.6W	716	10.8	11.9	3.3	8.5	07/05	15.8	SW	30.5	27/00	1018.8
46010	46.2N	124.2W	714	10.2	10.6	2.3	5.1	08/07	8.1	N	31.1	08/03	1018.8
46011	34.9N	120.9W	026	12.9	13.1	1.1	1.4	30/09	11.0	NW	20.6	30/08	1015.8
46013	38.2N	123.3W	720	10.9	10.4	2.3	4.5	08/09	13.2	NW	31.7	12/00	1018.2
46014	39.2N	124.0W	710	11.0	11.2	2.4	4.8	08/10	10.4	NW	28.3	19/02	1018.5
46016	63.3N	170.3W	239	-11.6					0.0	N			1008.1
46022	40.7N	124.5W	715	10.9	11.3	2.5	5.7	08/01	10.0	N	28.3	30/13	1019.6
46023	34.3N	120.7W	717	12.5	12.8	2.4	4.9	19/06	14.0	NW	27.8	12/01	1015.7
46025	33.7N	119.1W	718	14.8	15.6	1.0	2.5	03/16	5.4	W	23.4	03/18	1015.3
46026	37.8N	122.7W	714	11.3	11.8	1.8	3.4	08/05	10.0	W	23.8	18/10	1017.8
46027	41.8N	124.4W	545	10.6	11.0	2.6	4.9	08/01	9.4	NW	31.1	20/01	1020.6
46028	35.8N	121.9W	717	12.0	12.0	2.4	5.3	08/09	13.1	NW	27.5	12/02	1017.7
46035	57.0N	177.7W	716	-0.1	2.5	2.6	9.5	02/14	0.0	N			995.7
46036	48.3N	133.9W	720	8.1	9.0	3.6	8.2	16/11	13.6	SW	27.6	06/10	1013.5
51001	23.4N	162.3W	719	21.9	22.5	2.9	5.2	22/23	14.0	NE	24.6	01/04	1019.8
51002	17.2N	157.8W	717	24.1	24.9	2.6	4.7	02/10	14.8	E	26.7	02/10	1015.7
51003	19.2N	160.8W	718	23.7	24.8	2.6	4.9	01/12	12.2	NE	25.5	01/10	1016.4
51004	17.5N	152.6W	190	24.1	25.3	2.1	3.7	29/21	10.4	NE	22.1	28/17	1015.7
51005	20.4N	156.1W	718	22.7	23.9	2.0	4.2	01/12	17.8	NE	29.1	01/05	1017.8
ALRF1	24.9N	080.6W	717	21.2	23.1				10.3	W	24.0	01/05	1016.2
ALSN6	40.5N	073.8W	719	8.8	7.6				14.4	E	42.1	04/17	1014.4
BURL1	28.9N	089.4W	717	18.4					11.1	SW	32.0	03/09	1016.7
BUZM3	41.4N	071.0W	719	7.2					15.9	NE	43.1	05/00	1014.7
CARO3	43.3N	124.4W	719	10.1					8.2	N	31.0	05/21	1019.9
CHLV2	36.9N	075.7W	282	9.3	8.8	0.8	2.0	04/11	13.7	S	32.0	04/03	1011.7
CLKN7	34.6N	076.5W	710	14.4					12.2	N	29.0	26/23	1012.8
CSBF1	29.7N	085.4W	717	17.9					7.2	W	22.0	15/17	1015.9
DBLN6	42.5N	079.4W	629	7.9					10.9	SW	34.1	05/00	1015.5
DESW1	47.7N	124.5W	718	9.4					10.5	S	40.1	08/03	1018.0
DISW3	47.1N	090.7W	720	5.5					9.2	NE	36.1	01/12	1017.4
DPIA1	30.3N	088.1W	719	18.4	18.9				10.5	SW	31.7	03/09	1015.5
DSLN7	35.2N	075.3W	720	13.5	14.3				17.4	N	46.1	26/20	
FBIS1	32.7N	079.9W	720	15.5					7.8	SW	22.0	15/15	1012.8
FFIA2	57.3N	133.6W	720	5.7					12.5	SE	36.1	16/17	1009.7
FPSN7	33.5N	077.6W	718	15.6	18.2				0.0	N			1013.0
GDIL1	29.3N	090.0W	703	19.6	20.4				9.6	W	33.1	03/07	1016.1
GLLN6	43.9N	076.4W	678	7.4					10.5	NE	38.1	28/07	1014.0
IOSN3	43.0N	070.6W	720	5.4					13.9	NE	40.1	05/14	1015.4

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BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN WAVE HT (M)	MAX WAVE HT (M)	MAX WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
LKWF1	26.6N	080.0W	719	20.3	23.0				8.4	NW	23.0	15/07	1016.0
MDRM1	44.0N	068.1W	719	3.9					14.0	NE	40.1	13/16	1016.2
MISM1	43.8N	068.9W	720	4.0					14.8	NE	43.1	13/09	1015.8
NWPO3	44.6N	124.1W	720	9.8					8.2	E	27.0	08/05	1019.0
PILM4	48.2N	088.4W	718	3.4					8.8	N	31.0	27/15	1016.8
PTAC1	39.0N	123.7W	720	10.3					9.3	N	25.0	11/13	1017.8
PTAT2	27.8N	097.1W	718	19.0					10.2	SE	26.0	05/13	1016.8
PTGC1	34.6N	120.7W	717	12.4					14.4	N	35.1	18/12	1016.0
ROAM4	47.9N	089.3W	719	3.6	2.6				12.0	NE	42.1	01/16	1016.8
SAUF1	29.9N	081.3W	716	17.3					7.0	W	18.0	03/17	1015.0
SBIO1	41.6N	082.8W	720	8.5					10.7	E	34.1	04/19	1014.1
SGNW3	43.8N	087.7W	719	6.1	8.1				11.8	N	29.0	05/15	1015.7
SISW1	48.3N	122.8W	712	9.7					8.3	W	32.0	08/05	1017.8
SPGF1	26.7N	079.0W	668	21.6	24.1				6.5	NW	22.0	04/16	1017.5
SRST2	29.7N	094.1W	716	17.9					7.0	S	24.0	03/01	1019.4
STDM4	47.2N	087.2W	515	5.6					14.8	S	37.1	30/00	1015.5
SVLS1	32.0N	080.7W	718	15.9					12.4	S	35.1	04/02	1014.0
TPLM2	38.9N	076.4W	718	11.0	10.8				10.9	N	27.0	25/12	1013.6
TTIW1	48.4N	124.7W	719	9.0					12.0	SW	36.1	16/11	1018.3
VENF1	27.1N	082.5W	552	20.1	21.2				8.5	W	21.0	15/03	1015.7
WPOW1	47.7N	122.4W	720	9.9					7.9	S	24.0	16/18	1017.7
MAY		1987											
32302	18.0S	085.1W	728	20.8	22.6	2.2	4.4	13/23	12.9	SE	25.3	14/03	1016.0
41001	34.9N	072.9W	744	21.6	22.8	1.4	3.0	21/11	9.2	SW	21.6	09/06	1020.5
41002	32.2N	075.3W	741	22.1		1.3	3.1	09/08	9.0	S	22.8	09/05	1021.1
42001	25.9N	089.7W	742	25.7	26.1	0.6	1.7	03/20	7.5	E	20.7	12/03	1015.4
42002	26.0N	093.5W	743	24.9	25.6	0.9	3.4	04/00	11.0	SE	30.6	03/23	1014.8
42003	26.0N	085.9W	741	26.1	27.6	0.6	1.4	27/17	8.6	E	21.4	11/23	1016.3
42007	30.1N	088.9W	292	26.3	27.2	0.4	1.2	27/21	8.5	SE	15.9	26/08	1017.3
42015	30.2N	088.2W	743	24.4	25.3				7.9	SE	17.5	06/23	1016.2
42107	30.1N	088.9W	453	23.7	23.3	0.3	0.9	10/19	7.6	SE	21.4	10/11	1015.8
44004	38.5N	070.6W	743	17.2	18.0	1.5	4.1	20/17	9.3	SW	23.1	13/18	1019.7
44005	42.7N	068.3W	743	7.7	6.4	1.1	3.2	01/09	9.0	SW	22.6	05/01	1018.5
44007	43.5N	070.1W	743	9.5	7.3	0.7	2.4	05/20	0.0	N			1017.9
44008	40.5N	069.5W	677	9.6	7.2	1.2	3.6	01/01	11.0	SW	29.1	04/14	1018.2
44009	38.5N	074.6W	741	12.7	11.0	1.0	3.3	04/15	11.0	NE	29.1	04/15	1019.8
44011	41.1N	066.6W	744	8.8	7.1	1.4	3.9	01/01	8.7	SW	22.1	16/13	1018.9
44012	38.8N	074.6W	741	12.4	10.7	1.0	3.0	04/12	11.1	SW	31.1	05/02	1020.0
44013	42.4N	070.8W	742	12.0	8.9	0.5	2.5	05/17	9.3	N	27.2	05/09	1018.2
45001	48.0N	087.7W	744	5.3	2.9	0.5	3.7	22/07	3.2	N	21.4	22/02	1016.6
45002	45.3N	086.4W	727	6.4	4.1	0.5	2.0	09/05	8.0	SW	21.4	09/01	1017.6
45003	45.3N	082.8W	711	6.0	3.6	0.3	1.8	12/05	7.1	S	23.3	12/00	1018.2
45004	47.6N	086.5W	742	4.6	2.9	0.5	2.5	11/22	7.6	SE	25.3	11/20	1017.4
45005	41.7N	082.4W	743	14.1	12.9	0.4	1.8	19/04	7.3	S	25.3	30/22	1018.9
45006	47.3N	089.8W	734	5.1	2.8	0.5	3.2	22/13	7.1	NE	25.3	21/21	1016.1
45007	42.7N	087.1W	742	9.5	7.1	0.3	1.3	12/06	7.5	S	25.3	22/05	1017.3
45008	44.3N	082.4W	729	7.0	4.4	0.4	1.9	18/23	7.3	S	23.3	21/17	1018.6
46001	56.3N	148.3W	741	6.1	6.5	1.9	3.9	29/13	10.6	S	22.3	20/07	1007.0
46002	42.5N	130.4W	743	11.9	13.1	2.4	6.0	31/02	12.7	N	24.1	30/10	1020.3
46003	51.9N	155.9W	739	5.0	4.7	2.4	4.7	29/11	15.4	NW	32.2	29/08	1009.5
46004	50.9N	135.9W	744	7.8	8.0	2.6	8.0	03/20	13.7	SW	29.9	03/15	1013.3
46005	46.1N	131.0W	735	10.1	10.9	2.2	5.0	04/01	12.8	NW	22.0	29/22	1019.6
46006	40.8N	137.6W	740	11.8	13.3	2.3	6.4	30/18	6.9	N	25.2	01/23	1023.3
46010	46.2N	124.2W	719	11.6	12.0	2.0	5.0	30/15	0.0	N			1017.8
46011	34.9N	120.9W	741	13.0	13.7	1.9	3.8	03/09	11.8	NW	25.1	03/00	1014.7
46013	38.2N	123.3W	741	11.8	10.6	2.1	4.5	16/02	14.2	NW	33.3	16/01	1015.4
46014	39.2N	124.0W	744	12.0	11.8	2.1	4.5	16/02	12.5	NW	29.6	16/01	1015.7
46016	63.3N	170.3W	247	-1.6					0.0	N			1008.6
46022	40.7N	124.5W	741	11.5	11.4	2.3	6.4	19/06	10.6	N	27.0	19/18	1017.6
46023	34.3N	120.7W	743	13.4	14.2	2.1	4.0	03/08	14.0	NW	25.8	02/05	1014.4
46025	33.7N	119.1W	744	16.1	17.7	1.0	3.0	26/04	6.5	W	28.3	26/02	1013.9
46026	37.8N	122.7W	743	12.1	12.6	1.6	3.3	16/08	10.0	W	20.8	25/00	1015.3
46027	41.8N	124.4W	583	11.1	10.3	2.0	4.7	17/01	14.4	NW	40.8	18/23	1016.8
46028	35.8N	121.9W	741	13.0	13.4	2.2	4.1	16/16	12.1	NW	23.9	28/05	1016.1
46035	57.0N	177.7W	742	2.5	4.0	1.6	5.8	08/01	14.3	N	34.2	08/00	1010.6
46036	48.3N	133.9W	741	8.8	9.7	2.6	7.0	03/19	13.0	SW	23.4	28/01	1017.5
46040	44.8N	124.3W	092	11.7	12.8	2.9	5.1	30/16	13.1	S	29.1	30/13	1014.7
46043	46.9N	124.2W	619	11.2	11.4				0.0	N			1017.1

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BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN WAVE HT (M)	MAX WAVE HT (M)	MAX WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
51001	23.4N	162.3W	743	21.9	22.9	2.3	3.8	07/10	14.3	NE	24.9	07/07	1018.4
51002	17.2N	157.8W	743	24.5	25.5	1.9	3.7	08/14	10.2	E	21.3	03/20	1014.2
51003	19.2N	160.8W	744	23.7	25.0	2.0	3.7	08/12	10.8	NE	22.5	08/03	1015.0
51004	17.5N	152.6W	737	24.0	25.3	2.1	4.0	10/22	9.8	NE	25.7	08/06	1014.4
51005	20.4N	156.1W	743	23.0	24.4	1.8	3.3	25/03	13.7	NE	27.2	07/19	1015.8
ALRF1	24.9N	080.6W	735	25.4	26.5				12.0	E	24.0	31/17	1016.3
ALSN6	40.5N	073.8W	736	13.9	10.9				12.6	W	37.1	18/22	1020.1
BURL1	28.9N	089.4W	743	24.8					7.7	E	30.0	03/03	1016.5
BUZM3	41.4N	071.0W	742	11.0					14.3	SW	34.1	05/02	1019.6
CARO3	43.3N	124.4W	741	11.4					9.2	N	31.0	30/22	1018.6
CHLV2	36.9N	075.7W	168	17.9	15.4	0.8	1.7	08/15	12.8	S	30.0	08/14	1018.5
CLKN7	34.6N	076.5W	733	19.9					8.3	SW	22.0	16/13	1020.1
CSBF1	29.7N	085.4W	741	23.9					4.2	SE	12.0	08/21	1017.7
DBLN6	42.5N	079.4W	718	14.5					9.0	SW	26.0	10/08	1018.2
DESW1	47.7N	124.5W	741	10.6					10.8	NW	36.1	30/12	1016.9
DISW3	47.1N	090.7W	742	8.4					9.8	NE	31.0	18/07	1016.4
DPIA1	30.3N	088.1W	742	24.4	25.9				9.1	SE	24.8	06/22	1016.4
DSLN7	35.2N	075.3W	742	18.8	16.9				12.9	SW	30.0	05/02	1018.8
FBIS1	32.7N	079.9W	744	22.1					7.6	E	22.0	09/02	1018.8
FFIA2	57.3N	133.6W	742	8.1					7.8	SE	30.0	04/07	1013.1
FPSN7	33.5N	077.6W	740	21.2	21.9				6.8	N	28.0	09/00	1020.1
GDIL1	29.3N	090.0W	694	25.2	27.1				6.9	SE	20.0	03/01	1015.9
GLLN6	43.9N	076.4W	716	11.2					9.7	S	26.0	12/04	1018.0
IOSN3	43.0N	070.6W	740	11.5					11.7	S	32.0	06/04	1018.6
LKWF1	26.6N	080.0W	742	24.9	25.7				10.8	E	22.0	10/22	1017.9
MDRM1	44.0N	068.1W	460	6.6					13.0	SW	33.1	01/11	1016.3
MISM1	43.8N	068.9W	742	8.0					13.6	SW	34.1	01/11	1018.1
NWPO3	44.6N	124.1W	742	11.3					9.4	N	33.1	30/15	1017.7
PILM4	48.2N	088.4W	740	5.5					8.8	NE	38.1	09/05	1017.0
PTAC1	39.0N	123.7W	741	11.2					9.7	N	23.0	16/07	1014.5
PTAT2	27.8N	097.1W	742	24.6					11.6	SE	33.1	29/19	1013.7
PTGC1	34.6N	120.7W	740	13.2					15.4	N	31.0	25/07	1014.6
ROAM4	47.9N	089.3W	744	5.8	3.8				12.9	NE	39.1	22/02	1016.9
SAUF1	29.9N	081.3W	743	22.9					7.7	E	18.0	05/19	1018.7
SBIO1	41.6N	082.8W	734	16.4					7.2	E	27.0	30/22	1018.3
SGNW3	43.8N	087.7W	740	11.5	11.6				9.9	S	26.0	09/15	1017.5
SISW1	48.3N	122.8W	590	11.3					8.4	W	32.0	30/09	1015.8
SPGF1	26.7N	079.0W	742	24.8	26.4				8.4	E	19.0	30/14	1017.2
SRST2	29.7N	094.1W	740	24.3					8.3	S	30.0	04/01	1015.0
STDM4	47.2N	087.2W	742	7.5					14.2	S	35.1	14/00	1017.3
SVLS1	32.0N	080.7W	743	21.9					9.9	E	29.0	05/09	1019.2
TPLM2	38.9N	076.4W	740	17.1	16.5				8.6	S	24.0	16/08	1019.7
TTIW1	48.4N	124.7W	214	10.9					11.0	S	27.0	01/20	1018.1
VENF1	27.1N	082.5W	733	23.7	25.9				6.8	E	17.0	30/18	1017.4
WPOW1	47.7N	122.4W	741	12.2					8.0	S	26.0	01/05	1016.2
JUN		1987											
32302	18.0S	085.1W	709	19.7	21.2	2.2	3.9	15/21	12.9	SE	25.3	14/06	1017.0
41001	34.9N	072.9W	513	23.8	24.1	1.3	2.4	15/15	11.0	SW	20.9	15/06	1018.9
41002	32.2N	075.3W	720	25.6		1.2	2.9	27/20	9.5	SW	21.6	27/14	1019.5
41006	29.3N	077.4W	679	26.3	27.1	1.1	2.2	27/16	8.4	S	26.9	28/15	1017.8
42001	25.9N	089.7W	623	27.4	28.0	0.6	2.4	09/11	8.7	SE	20.4	21/12	1015.2
42002	26.0N	093.5W	719	27.2	28.1	0.7	1.8	10/02	9.9	SE	22.6	10/18	1014.6
42003	26.0N	085.9W	720	27.8	28.4	0.7	2.1	08/19	9.1	E	21.9	27/06	1016.3
42007	30.1N	088.9W	719	27.0	27.6	0.4	1.5	06/20	8.0	SE	23.1	05/02	1015.3
42015	30.2N	088.2W	718	26.6	28.0				8.5	SW	21.4	05/01	1015.6
44004	38.5N	070.6W	719	21.1	21.6	1.3	2.8	08/16	10.8	SW	22.8	13/06	1015.9
44005	42.7N	068.3W	720	12.8	11.5	1.1	2.8	23/23	9.3	SW	23.5	23/17	1013.1
44007	43.5N	070.1W	719	14.9	13.2	0.7	2.1	23/17	0.0	N			1012.7
44008	40.5N	069.5W	719	13.7	10.7	1.1	2.6	12/23	10.0	SW	21.4	08/07	1013.9
44009	38.5N	074.6W	718	19.6	18.7	0.8	2.6	24/07	10.1	SW	25.3	12/13	1015.7
44011	41.1N	066.6W	720	12.1	10.2	1.4	3.1	13/22	9.1	SW	17.8	09/08	1014.1
44012	38.8N	074.6W	715	19.3	18.0	0.7	2.1	24/04	9.7	SW	25.3	12/14	1015.7
44013	42.4N	070.8W	719	17.1	14.2	0.4	2.4	23/21	8.8	E	23.3	23/18	1013.2
45001	48.0N	087.7W	719	8.3	4.2	0.3	1.1	11/15	8.8	SW	17.6	02/07	1012.4
45002	45.3N	086.4W	719	14.7	13.3	0.5	1.9	11/18	7.7	SW	23.3	11/18	1013.0
45003	45.3N	082.8W	677	12.3	10.2	0.3	1.6	08/19	6.5	S	21.4	08/19	1013.0
45004	47.6N	086.5W	718	6.9	4.3	0.3	1.8	08/17	5.8	W	19.4	04/00	1013.1
45005	41.7N	082.4W	719	20.6	20.6	0.3	1.2	28/01	8.6	SW	21.4	20/04	1014.5
45006	47.3N	089.8W	714	8.8	5.9	0.2	0.9	03/15	5.4	SW	17.5	04/16	1013.1
45007	42.7N	087.1W	717	17.8	16.5	0.3	1.5	09/06	7.0	S	17.5	02/13	1013.4

U.S. NDBC Climatological Data cont'd

April, May and June 1987

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN WAVE HT (M)	MAX WAVE HT (M)	MAX WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
45008	44.3N	082.4W	690	14.2	12.3	0.4	1.5	09/18	6.9	S	21.4	15/03	1013.6
46001	56.3N	148.3W	718	7.8	8.2	2.3	6.3	24/09	12.2	E	28.8	16/15	1004.3
46002	42.5N	130.4W	717	13.1	14.2	2.2	4.9	01/01	10.7	N	20.3	20/05	1021.7
46003	51.9N	155.9W	715	6.6	5.8	2.4	8.1	29/07	15.4	W	36.6	29/07	1004.3
46004	50.9N	135.9W	720	9.2	9.3	2.5	4.9	19/23	13.1	SW	25.1	17/04	1016.1
46006	40.8N	137.6W	715	13.2	14.2	2.0	4.6	20/13	0.0	N			1024.5
46010	46.2N	124.2W	686	12.5	12.5	1.8	4.3	01/01	0.0	N			1019.4
46011	34.9N	120.9W	717	12.8	12.9	1.8	3.9	01/08	10.6	NW	26.3	22/01	1015.1
46012	37.4N	122.7W	336	12.2	12.6	1.7	3.1	22/23	7.2	NW	19.4	17/07	1016.5
46013	38.2N	123.3W	719	11.6	10.1	2.0	4.5	01/02	11.3	NW	27.3	10/03	1016.1
46014	39.2N	124.0W	718	11.9	11.6	2.1	4.3	02/04	11.6	NW	26.4	10/04	1016.1
46016	63.3N	170.3W	239	3.9					0.0	N			1005.7
46022	40.7N	124.5W	717	11.7	11.2	2.2	4.8	02/07	10.8	N	23.1	04/20	1017.7
46023	34.3N	120.7W	716	13.2	13.3	2.0	4.1	01/10	12.3	NW	24.3	22/13	1014.9
46025	33.7N	119.1W	719	16.1	17.9	0.9	1.7	24/14	5.4	W	17.1	21/23	1014.5
46026	37.8N	122.7W	718	12.1	12.6	1.5	3.2	01/04	8.7	W	21.0	17/05	1015.9
46027	41.8N	124.4W	716	11.3	10.3	2.0	4.3	02/04	10.4	N	35.0	02/01	1017.7
46028	35.8N	121.9W	716	13.4	13.6	2.2	4.4	01/05	11.3	NW	27.9	22/02	1016.4
46035	57.0N	177.7W	495	4.8	5.5	1.6	4.8	03/13	13.2	N	28.9	03/08	1004.6
46036	48.3N	133.9W	716	10.0	10.6	2.3	5.6	01/02	11.6	S	24.1	19/20	1019.8
46039	48.2N	123.4W	480	11.1	10.1	0.5	1.5	15/03	10.9	W	29.1	15/04	1017.2
46040	44.8N	124.3W	720	12.5	12.5	2.0	4.5	01/02	11.5	N	23.3	03/03	1019.3
46041	47.4N	124.5W	507	11.8	12.1	1.8	3.9	22/07	8.6	NW	19.4	14/02	1018.5
46042	36.8N	122.2W	301	12.2	12.7				8.6	NW	25.3	23/01	1015.6
46043	46.9N	124.2W	720	11.8	11.6				0.0	N			1019.2
51001	23.4N	162.3W	718	23.7	23.6	2.0	2.9	03/15	13.4	E	19.8	15/10	1019.0
51002	17.2N	157.8W	718	25.6	26.2	2.1	3.2	15/09	14.4	E	22.7	17/11	1015.1
51003	19.2N	160.8W	716	25.3	26.3	1.8	3.0	16/00	11.1	NE	19.7	14/16	1015.8
51004	17.5N	152.6W	712	25.0	25.8	2.2	3.3	10/15	13.9	NE	22.2	17/00	1015.6
51005	20.4N	156.1W	715	24.1	25.0	1.5	2.4	15/13	16.4	NE	25.3	15/18	1017.3
ALRF1	24.9N	080.6W	703	27.4	28.2				12.0	NW	25.0	08/02	1016.8
ALSN6	40.5N	073.8W	720	19.7	16.6				12.3	SW	34.1	09/03	1015.3
BURL1	28.9N	089.4W	714	26.7					10.2	E	26.0	08/20	1016.0
BUZM3	41.4N	071.0W	718	16.4					13.5	SW	30.0	23/20	1014.5
CARO3	43.3N	124.4W	714	11.8					9.0	N	29.0	20/20	1019.3
CHLV2	36.9N	075.7W	718	22.2	20.7	0.6	1.3	18/00	11.7	SW	27.0	13/22	1016.0
CLKN7	34.6N	076.5W	711	24.3					10.1	SW	22.0	14/15	1017.3
CSBF1	29.7N	085.4W	661	26.8					6.4	S	19.0	14/13	1016.9
DBLN6	42.5N	079.4W	720	20.1					8.7	SW	31.0	08/16	1013.5
DESW1	47.7N	124.5W	714	11.7					10.5	NW	31.0	26/01	1018.9
DISW3	47.1N	090.7W	720	14.8					8.2	SW	22.0	03/11	1012.2
DPIA1	30.3N	088.1W	716	26.7	28.3				9.0	SE	27.0	05/00	1015.7
DSLN7	35.2N	075.3W	719	23.6	23.8				14.6	SW	29.0	09/22	1018.1
FBIS1	32.7N	079.9W	717	25.7					9.1	SW	21.0	13/06	1017.3
FFIA2	57.3N	133.6W	713	10.0					7.8	SE	28.0	17/16	1015.3
FPSN7	33.5N	077.6W	719	24.9	26.1				13.3	SW	31.0	27/04	1017.4
GDIL1	29.3N	090.0W	713	26.8	28.2				8.7	SE	23.0	17/15	1015.5
GLLN6	43.9N	076.4W	689	17.8					9.7	S	28.0	26/12	1012.9
IOSN3	43.0N	070.6W	720	16.6					10.8	SW	30.0	23/14	1013.7
LKWF1	26.6N	080.0W	704	27.0	27.7				9.5	SE	21.0	07/16	1017.9
MDRM1	44.0N	068.1W	269	11.9					13.4	SW	28.0	28/01	1013.0
MISM1	43.8N	068.9W	720	12.3					13.6	SW	31.0	27/20	1012.7
NWPO3	44.6N	124.1W	714	11.6					9.9	N	26.0	02/23	1018.7
PILM4	48.2N	088.4W	718	9.7					9.1	SW	26.0	16/05	1012.4
PTAC1	39.0N	123.7W	711	11.2					10.3	N	28.0	03/20	
PTAT2	27.8N	097.1W	712	26.8					10.4	SE	23.0	01/03	1014.0
PTGC1	34.6N	120.7W	715	12.9					14.1	N	30.0	09/06	1015.0
ROAM4	47.9N	089.3W	719	10.1	5.2				11.7	W	34.1	12/20	1012.4
SAUF1	29.9N	081.3W	716	25.7					8.0	SE	19.0	12/23	1018.0
SBIO1	41.6N	082.8W	709	21.8					8.4	SW	38.1	29/18	1015.0
SGNW3	43.8N	087.7W	715	18.5	14.8				8.9	S	23.0	06/20	1013.5
SISW1	48.3N	122.8W	613	12.2					8.7	W	28.0	15/07	1016.8
SPGF1	26.7N	079.0W	712	26.9	28.1				5.1	SE	19.0	08/12	
SRST2	29.7N	094.1W	714	26.6					9.1	S	24.0	10/13	1015.0
STDM4	47.2N	087.2W	720	12.4					12.4	S	30.0	02/02	1013.0
SVLS1	32.0N	080.7W	719	25.9					11.6	S	29.0	23/22	1017.6
TPLM2	38.9N	076.4W	718	23.0	22.8				8.4	S	22.0	30/01	1015.3
TTIW1	48.4N	124.7W	597	11.4					9.9	S	31.0	12/12	1018.7
VENF1	27.1N	082.5W	703	26.4	29.5				7.0	E	20.0	26/23	1017.8
WPOW1	47.7N	122.4W	714	13.8					7.2	NE	21.0	12/08	1017.6

Selected Gale and Wave Observations

April, May and June, 1987

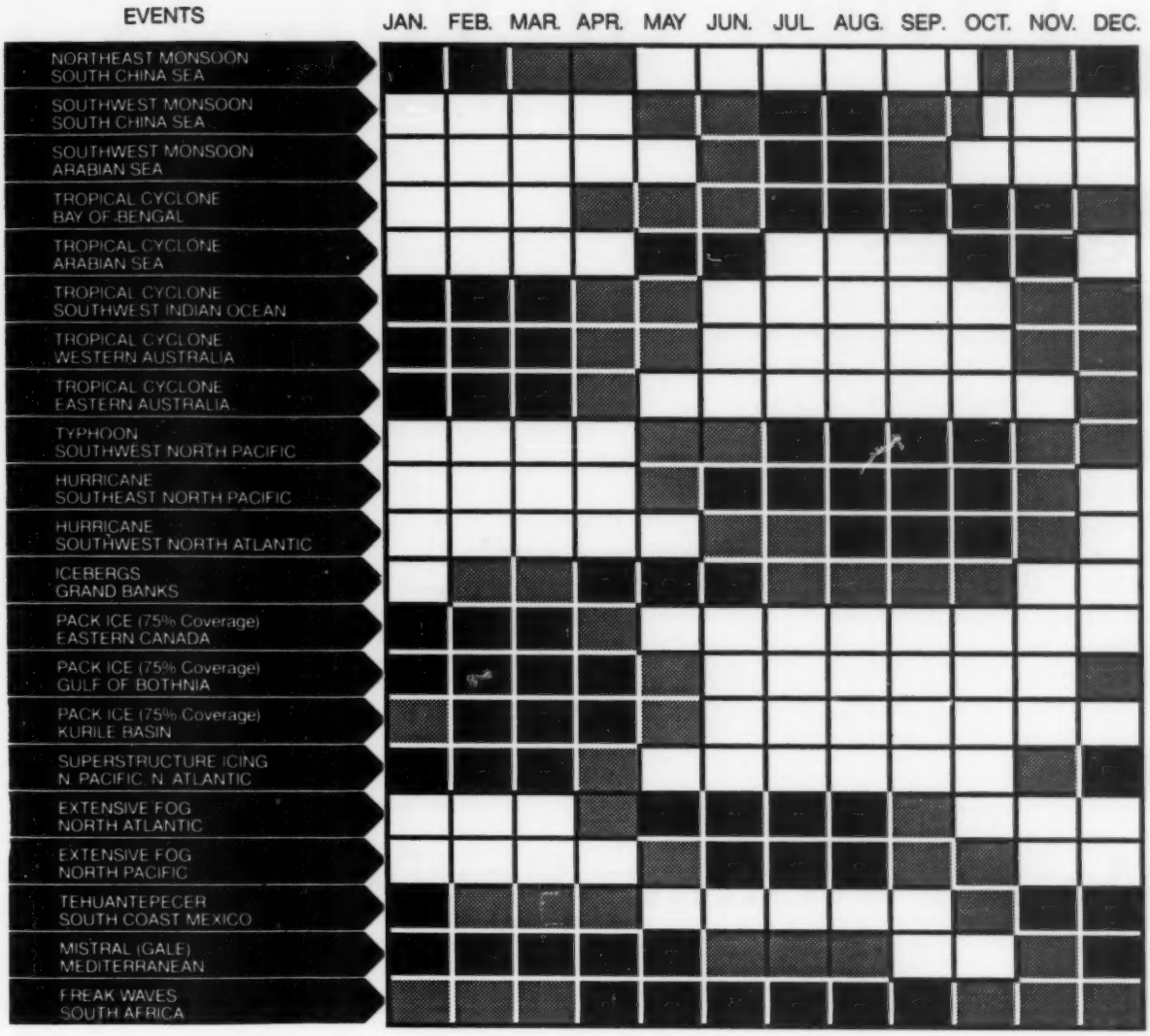
VESSEL	SHIP CALL	DATE	POSITION LAT. DEG.	POSITION LONG. DEG.	TIME GMT	WIND DIR. 10 DEG.	WIND SPEED KTS.	VSBY	PRES WX. CODE	PRESSURE MBS.	TEMP DEG C. AIR	TEMP DEG C. SEA	SEA WAVES PD. SEC	SEA WAVES HGT. FT.	SWELL WAVES DIR	SWELL WAVES PD. SEC	SWELL WAVES HGT. FT.
	PACIFIC	APR.															
BULK GARLAND	3EZT3	1	14.4 N	95.6 W	00	02	M 43			1009.0	23.5	26.0	4	19.5	02	9	23
PRESIDENT LINCOLN	KDBG	1	33.6 N	151.9 W	00	32	48	10 NM	02	1018.0	10.6	16.1	6	21	32	10	44
PRESIDENT LINCOLN	KDBG	1	33.6 N	152.8 W	06	31	45	10 NM	02	1020.0	11.1	15.6	9	42.5	32	14	52.5
MANULANI	KNIJ	1	33.5 N	145.7 W	06	28	40	10 NM	01	1014.0	11.1	15.6	4	14.5	28	8	26
PRESIDENT LINCOLN	KDBG	1	33.7 N	154.6 W	12	34	45	10 NM	01	1024.5	11.0	15.6	8	21	34	12	26
CORNELIA MAERSK	OVPU	1	53.8 N	175.4 W	12	15	45	2 NM	50	0976.0	5.0		6	10	12	12	19.5
ORIENTAL PATRIOT	BMDH	1	48.0 N	168.1 E	18	27	M 50	5 NM	70	0984.0	- 1.0	1.0	10	16.5	29	14	19.5
SEALAND MARINER	KGJF	1	50.0 N	176.1 W	18	25	M 40	5 NM	27	0975.5	2.2		6	14.5	20	10	19.5
USCGC YOCONA (WMEC 168)	NNHB	1	53.5 N	169.4 W	18	13	M 45	.5 NM	81	0982.8	5.6	5.6	3	8	17	6	19.5
CORNELIA MAERSK	OVPU	1	54.1 N	172.8 W	18	14	45	2 NM	50	0969.0	5.0		10	26			
ORIENTAL PATRIOT	BMDH	2	48.7 N	170.6 E	00	25	M 45	2 NM	70	0980.0	- 2.5	2.0	18	23	27	24	32.5
SEALAND LIBERATOR	KHRP	2	43.0 N	151.5 W	00	31	M 40	10 NM	03	1009.4	7.0		3	10	33	8	19.5
USCGC MIDGETT (WHEC 726)	NHWR	2	56.7 N	166.2 W	00	13	M 50	2 NM	80	0986.0	3.9	1.1	5	6.5	13	9	23
SEVEN OCEAN	DZRK	2	54.3 N	165.0 W	04	15	M 42	< 50 YD	68	0990.0	3.0	3.0	10	24.5	15	10	24.5
SEA DIAMOND	3FJR2	2	54.0 N	161.1 W	06	15	M 48	2 NM	07		4.0	7.0	11	19.5	14	14	34.5
ORIENTAL PATRIOT	BMDH	2	49.4 N	173.8 E	06	25	M 55	2 NM	70	0978.0	0.0	2.0	10	16.5	27	14	23
KOFUKU MARU	JKLB	2	53.5 N	176.2 E	06	23	M 50	.25 NM	88	0946.0	2.0	3.0	6	13	23	XX	26
USCGC MIDGETT (WHEC 726)	NHWR	2	56.6 N	165.9 W	06	14	M 42	2 NM	80	0983.9	4.0	1.7	7	26			
KOFUKU MARU	JKLB	2	53.5 N	176.0 E	12	23	M 53	.25 NM	88	0954.5	2.0	3.0	6	13	23	XX	26
ORIENTAL PATRIOT	BMDH	2	49.9 N	180.0 E	18	22	M 45	2 NM	70	0985.5	- 1.0	2.0	8	16.5	27	14	19.5
KOFUKU MARU	JKLB	2	53.4 N	175.7 E	18	24	M 40	.25 NM	84	0963.5	2.0	3.0	5	13	23	10	23
ORIENTAL PHOENIX	DUAV	5	42.4 N	161.9 W	06	29	M 52	.5 NM	80	0985.3	5.0	7.0	7	14.5	22	8	19.5
ORIENTAL PHOENIX	DUAV	5	42.4 N	159.8 W	12	29	M 51	.25 NM	80	0992.5	4.0	7.0	8	19.5	29	9	26
ORIENTAL PHOENIX	DUAV	5	42.0 N	157.7 W	18	29	M 45	.25 NM	80	1001.5	5.0	7.0	8	31	29	9	26
SEALAND ENDURANCE	KGJX	5	39.2 N	170.3 E	18	29	M 49	10 NM	87	1007.0	6.1		8	13	27	12	19.5
ORIENTAL PHOENIX	DUAV	6	41.4 N	155.8 W	00	27	M 44	5 NM	80	1006.8	8.0	8.0	7	18	28	7	24.5
SEALAND ENDURANCE	KGJX	6	39.9 N	175.5 E	06	27	M 50	10 NM		1003.5	6.1	8.0	8	13	28	15	26
PRESIDENT GRANT	WEZD	8	50.7 N	130.7 W	06	23	40	10 NM	58	0982.0	9.4	10.0	5	6.5	23	11	19.5
SEALAND BOSTON	WNDW	9	50.8 N	130.0 W	18	17	42	2 NM	61	1006.1	11.1	6.7	4	6.5	16	9	19.5
OVERSEAS JUNEAU	WWND	10	54.4 N	137.9 W	00	18	45	10 NM	15	0981.0	7.8	6.1	5	8	13	8	19.5
EVER LOADING	3EWM2	10	35.5 N	174.0 E	06	33	M 48	1 NM	50	1006.5	11.0	15.0	8	13	33	20	19.5
OVERSEAS JUNEAU	WWND	10	53.6 N	137.2 W	06	18	48	5 NM	01	0985.0	6.1	7.2	6	8	17	10	19.5
OVERSEAS JUNEAU	WWND	10	53.0 N	137.9 W	12	20	48	5 NM	93	0985.5	6.1	6.1	6	8	17	10	19.5
CHASTINE MAERSK	OWCY	10	49.8 N	147.1 W	18	27	40	5 NM	02	0999.3	5.8		10	16.5	27	12	23
OVERSEAS JUNEAU	WWND	10	52.3 N	136.0 W	18	17	40	5 NM	01	0986.0	6.7	6.7	6	8	18	10	23
HANJIN POHANG	D8ON	11	43.5 N	153.0 E	00	18	M 45	.5 NM	83	0989.0	6.0	4.0	17	16.5	18	20	23
CHASTINE MAERSK	OWCY	11	49.7 N	144.5 W	00	27	40	5 NM	02	1002.3	7.2		12	26			
CHRISTIAN MAERSK	OXJF	11	40.1 N	147.1 E	12	27	45			1004.5	4.0	0.0	XX	23			
ALTAMONTE	DZBD	12	45.1 N	155.7 E	00	24	M 48			0985.5	2.0	8.0	9	32.5	24	9	31
CHEVRON WASHINGTON	KFDB	12	34.9 N	121.3 W	00	33	M 40	10 NM		1014.0	12.3		4	6.5	32	6	19.5
ALTAMONTE	DZBD	12	44.6 N	155.8 E	06	24	M 41	5 NM		0988.0	2.0	8.0	8	19.5	24	8	19.5
ALTAMONTE	DZBD	12	43.9 N	155.6 E	12	26	M 41	5 NM		0995.0	2.0	8.0	7	23	26	7	23
ALLIGATOR HOPE	ELFN8	14	53.8 N	155.4 W	00	24	M 40	5 NM	00	0971.0	5.0	3.0	10	26	24	12	29.5
ORIENTAL PATRIOT	BMDH	14	54.0 N	154.0 W	06	25	M 50	5 NM	84	0971.5	4.5	4.0	8	13	23	12	19.5
ALLIGATOR HOPE	ELFN8	14	53.9 N	157.9 W	06	26	M 40	2 NM	88	0971.0	4.0	3.0	14	29.5	26	13	29.5
MOBIL ARCTIC	KSPY	14	57.2 N	141.0 W	12	19	48	10 NM		0978.6	5.6	4.4	3	6.5	17	8	24.5
AQUA GARDEN	C6BD9	14	54.8 N	153.9 W	18	28	M 41			0976.0	4.0	5.0	12	23	28	12	23
COUNTESS-SKY	3ERP2	15	48.2 N	149.1 W	18	26	M 40	2 NM	25	0992.5	4.5	4.0	8	16.5	27	10	23
UNITED HOPE	VRDP	15	47.3 N	153.1 W	18	27	45	5 NM	01	1002.8	6.0	6.0	5	19.5	27	8	21
MOBIL ARCTIC	KSPY	16	53.1 N	134.6 W	00	20	55	.5 NM	21	0981.0	7.2	6.1	18	29.5	20	20	32.5
UNITED HOPE	VRDP	16	47.4 N	151.6 W	00	27	M 41	5 NM		1007.0	6.0	7.0	4	16.5	27	9	19.5
ATIGUN PASS	KSFJ	16	47.8 N	132.5 W	06	27	40	10 NM	25	1007.5	8.9	10.0	3	6.5	24	12	23
MOBIL ARCTIC	KSPY	16	52.8 N	134.0 W	06	20	65	1 NM	25	0985.0	6.5	6.1	15	26	20	20	41
ATIGUN PASS	KSFJ	16	49.3 N	133.5 W	18	27	41	10 NM	14	1011.0	10.0	7.8	3	10	27	12	21
ORIENTAL EXECUTIVE	D5AN	17	34.7 N	171.3 E	00	19	M 48	200 YD	55	1009.8	16.5	14.0	7	13	22	8	19.5
ALASKA RAINBOW	3ECL4	17	47.5 N	171.1 W	18	20	M 44	.5 NM	45	0985.5	6.0	4.0	5	18	18	5	19.5
ALASKA RAINBOW	3ECL4	18	47.5 N	169.9 W	00	25	M 47			0990.0	5.0	4.0	6	21	25	6	21
ALASKA RAINBOW	3ECL4	18	47.5 N	168.3 W	06	24	M 49			0992.0	4.5	4.0	5	19.5	25	6	23
ALASKA RAINBOW	3ECL4	18	47.5 N	166.6 W	12	25	M 55	1 NM	60	0994.0	4.0	4.0	6	21	25	6	23
ALASKA RAINBOW	3ECL4	18	47.5 N	164.9 W	18	26	M 54	1 NM	50	0993.0	4.0	4.0	6	19.5	25	6	23
PRESIDENT FILLMORE	KRDH	18	53.7 N	168.5 W	18	36	55	5 NM	01	0994.2	1.7	7.8	5	16.5	36	7	21
ALASKA RAINBOW	3ECL4	19	47.4 N	163.0 W	00	29	M 42	10 NM	50	0998.0	5.0	4.0	6	19.5	29	6	21
ALASKA RAINBOW	3ECL4	19	47.4 N	161.3 W	06	29	M 42			1003.0	4.0	4.0	6	19.5	29	6	19.5
GALVESTON	KBGA	19	58.7 N	148.9 W	12	10	45	5 NM	21	0989.1	2.8	5.6	5	10	12	11	26
CORNUCOPIA	KPJC	19	50.8 N	136.1 W	12	22	45	2 NM	07	1007.7	4.3	6.3	7	14.5	22	12	23
CHASTINE MAERSK	OWLY	19	54.2 N	158.4 W	18	32	40	10 NM	01	0995.8	3.7		7	19.5			

Selected Gale and Wave Observations (cont'd)

April, May and June, 1987

VESSEL	SHIP CALL	DATE	POSITION LAT. DEG.	POSITION LONG. DEG.	TIME GMT	WIND DIR. 10 DEG.	WIND SPEED KTS.	VSBY	PRES WX. CODE	PRESSURE MBS.	TEMP DEG C. AIR	TEMP DEG C. SEA	SEA WAVES PD. SEC	SEA WAVES HGT. FT.	SWELL WAVES DIR	SWELL WAVES PD. SEC	SWELL WAVES HGT. FT.
CHEVRON MISSISSIPPI	WXBR	20	49.3 N	151.5 W	12	28	M 40	5 NM		1012.4	5.6	4.0	5	8	28	11	19.5
MICROBA	VPDF	24	37.9 N	179.4 E	06	08	M 45	1 NM	52	1020.6	12.5	13.0	6	11.5	08	9	21
MICROBA	VPDF	24	37.5 N	179.4 W	18	08	M 41	2 NM		1027.6	13.0	12.0	4	10	08	8	19.5
HANJIN POHANG	D8ON	25	47.4 N	165.7 E	00	14	M 40	200 YD	45	1018.0	4.0	5.0	17	16.5	14	20	23
PRESIDENT WASHINGTON	WHRN	25	41.4 N	170.4 E	18	15	M 46	5 NM	02	1023.5	6.7	5.6	7	16.5	14	14	24.5
WESTWARD VENTURE	KHJB	26	53.6 N	135.3 W	18	17	M 40	1 NM	62	1004.0		7.8	3	11.5	13	12	21
LUCENT STAR	6ZBM	28	48.1 N	167.3 E	00	28	M 40	5 NM	03	1004.5	1.5	3.0	12	23	28	12	23
PRESIDENT ARTHUR	WGLA	28	53.3 N	179.0 W	09	30	M 44	5 NM	02	0971.0	2.2	0.6	8	13	18	18	49
PACIFIC DOWN	DVSM	28	49.8 N	139.5 W	23	18	M 40	2 NM	50	0986.2	6.8	7.5	6	14.5	17	8	19.5
IBIS ARROW	LWPE	29	50.5 N	175.2 W	00	28	M 45	5 NM		0996.0	3.0	6.0	8	23			
PACIFIC DOWN	DVSM	29	49.9 N	138.6 W	03	21	M 42	5 NM	25	0993.7	11.5	7.0	6	14.5	18	8	19.5
KEYSTONE CANYON	KSFK	29	55.6 N	136.4 W	06	18	M 45	2 NM	82	0996.1	7.2	7.2	5	11.5	18	9	24.5
IBIS ARROW	LWPE	29	50.8 N	172.9 W	06	30	M 40	10 NM		0996.0	4.0	6.0	4	19.5	26	10	21
PRESIDENT WILSON	WNPD	29	49.4 N	138.2 W	06	22	40	2 NM		1000.0	6.7	7.2	6	23	18	8	19.5
	PACIFIC	MAY															
WINTER STAR	S6BJ	4	34.6 N	144.6 E	00	35	40	10 NM		1010.5	14.5	19.7	XX	19.5	35	XX	19.5
OAK GLORY	ELBO6	4	40.2 N	154.4 W	06	33	M 40	200 YD	04	1010.3	9.0	10.0	5	18	26	15	19.5
HANJIN LONG BEACH	3ERK4	5	41.4 N	140.5 E	02	21	M 44	1 NM		1002.0	12.0	9.0	9	19.5	22	10	23
EVER SUMMIT	BKHV	5	42.7 N	156.8 W	21	28	M 51	.5 NM	44	0999.0	6.5		15	21	28	10	16.5
HANJIN POHANG	D8ON	7	43.3 N	150.5 E	00	32	M 48			0992.0	0.0	5.0	20	23	32	23	29.5
PHILADELPHIA	WJGO	7	54.0 N	136.2 W	06	16	M 40	5 NM		1016.0	10.0	7.8			22	XX	19.5
BROOKLYN	KGDB	16	51.8 N	136.7 W	01	23	M 50	.5 NM	12	0980.5	8.3	8.9	12	23			
EXXON PHILADELPHIA	WNFJ	16	39.6 N	124.6 W	18	36	M 41	2 NM		1015.9	13.3	14.4	6	19.5	29	8	6.5
FERNCROFT	LLEJ	17	40.9 N	124.9 W	06	36	40	5 NM		1015.0	11.5	10.4	13	19.5			
EXXON PHILADELPHIA	WNFJ	20	39.8 N	125.7 W	00	33	M 40	5 NM		1013.2	12.8	11.7	6	18	33	8	26
FERNCROFT	LLEJ	20	41.0 N	124.6 W	06	34	40	5 NM		1011.0	10.0	8.3	14	19.5			
M.S. NOSAC SKAUKAR	ELFZ8	24	38.4 N	150.2 E	06	21	M 41	.5 NM		0997.5	21.0		12	19.5	21	10	13
ARCO FAIRBANKS	WGWB	29	51.3 N	132.9 W	18	13	M 47	2 NM	65	0990.4	10.0	8.3	8	6.5	14	10	21
KEYSTONE CANYON	KSFK	30	55.8 N	139.4 W	06	09	40	2 NM	60	0986.5	7.8	8.3	5	13	11	8	19.5
SEALAND ENDURANCE	KGJX	30	44.2 N	136.1 W	12	27	M 40	5 NM		0996.5	10.6		7	10	27	15	19.5
SEALAND ENDURANCE	KGJX	30	43.6 N	137.2 W	18	29	M 40	5 NM	15	1003.2	10.6	10.0	8	14.5	27	12	26
LAUST MAERSK	OXGS	31	49.0 N	136.0 W	18	26	40	5 NM	80	1005.0	7.2		10	23			
	PACIFIC	JUNE															
PHILADELPHIA	WJGO	7	54.0 N	136.2 W	06	16	M 40	5 NM		1016.0	10.0	7.8			22	XX	19.5
DYUI SKAGERAK	DUVB	19	45.8 N	155.0 W	06	28	M 64	1 NM		0993.0	7.8	8.0	7	24.5	28	12	19.5
DYUI SKAGERAK	DUVB	19	45.9 N	156.5 W	12	28	M 64	1 NM		1007.0	7.0	7.0	7	24.5	30	12	19.5
CHEVRON CALIFORNIA	WCGN	23	47.9 N	151.1 W	12	18	M 45	2 NM	62	0975.0	7.2	6.7	10	24.5			
PACMONARCH	5MTA	23	49.9 N	140.4 W	18	15	M 42	1 NM		1001.0	10.0	8.0	4	19.5			
CHEVRON CALIFORNIA	WCGN	23	47.5 N	151.2 W	18	24	M 55	2 NM	60	0990.8	8.3	6.7	6	24.5	14	8	19.5
CHEVRON CALIFORNIA	WCGN	24	47.0 N	151.3 W	00	23	M 44	2 NM	07	1002.5	9.4	6.7	9	21			
	ATLANTIC	APR.															
CHARLOTTE LYKES	WPHZ	3	45.5 N	22.6 W	00	34	41	10 NM		1013.8	10.1	13.0	6	16.5	36	10	19.5
CHARLOTTE LYKES	WPHZ	3	45.9 N	20.9 W	06	36	40	5 NM		1005.9	7.8	11.0	6	16.5	36	10	19.5
CHARLOTTE LYKES	WPHZ	3	46.4 N	19.3 W	12	36	40	10 NM	25	0999.5	7.8	11.0	3	16.5	36	6	23
CHARLOTTE LYKES	WPHZ	3	46.8 N	17.9 W	18	36	45	5 NM	64	0988.8	9.4	11.0	5	16.5	36	6	21
CHARLOTTE LYKES	WPHZ	4	47.2 N	16.9 W	00	36	40	5 NM	01	0988.0	9.4	12.0	3	16.5	36	6	21
CHARLOTTE LYKES	WPHZ	4	47.5 N	16.2 W	06	36	40	5 NM		0986.5	10.6	11.0	3	16.5	36	6	19.5
SEALAND PIONEER	WSVB	4	40.4 N	54.5 W	06	30	M 40	2 NM	81	1013.9	11.0		7	19.5	29	9	18
EXPORT CHAMPION	WLCG	6	32.7 N	74.3 W	00	25	41	5 NM	60	1008.9	17.8	18.9	4	13	26	7	19.5
SEALAND ADVENTURER	KSLJ	13	38.5 N	44.2 W	12	29	40	5 NM	81	1007.0	14.0	18.3	4	10	29	8	19.5
SEALAND LEADER	WSNH	25	37.1 N	28.1 W	12	34	M 40	10 NM	25	1020.0	13.5		5	13	34	12	19.5
AMERICAN CONDOR	WJRG	27	41.3 N	60.9 W	06	08	54	5 NM	83	1021.5	5.8		3	19.5	08	4	16.5
TRAVE ORE	ELBZ4	27	39.0 N	64.9 W	18	06	M 53	.5 NM	59	1013.0	17.0	19.0	4	13	07	15	49
TRAVE ORE	ELBZ4	28	40.1 N	62.4 W	18	07	M 50	1 NM		1015.0	18.0	21.0	5	6.5	05	15	19.5
	ATLANTIC	MAY															
AMERICAN CONDOR	WJRG	1	38.6 N	26.4 W	18	36	52	2 NM	80	1013.9			8	8	36	12	24.5
CHELSEA	KNCX	28	46.7 N	36.0 W	12	24	45	5 NM	02	0991.5	15.6	13.3	6	23	22	7	19.5
CHELSEA	KNCX	29	46.1 N	37.3 W	00	29	45	5 NM	15	1006.5	12.8	13.3	6	19.5	27	7	16.5
CHELSEA	KNCX	30	44.0 N	45.2 W	06	19	55	5 NM	00	0999.0	15.6	15.6	6	19.5	19	6	14.5
	ATLANTIC	JUNE															
MARGARET LYKES	KRJL	26	36.8 N	39.6 W	15	23	40	5 NM	81	1016.0	22.2	20.0	5	13	29	10	21

Meteorological Events by Month



Period of Likely Occurrence

Peak Period

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